FINAL PERFORMANCE REPORT

Coherence-based Modeling of Cultural Change and Political Violence

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ACCOMPLISHMENTS SUMMARY

The Coherence-Based Cultural Change and Political Violence Project (CCPV) accomplished: (1) Completion of integrated model of cultural change based upon grid-group model of culture, coherence model of preference and belief change, and rational choice model of action. (2) Application of this model to predict ethnic conflict via middle-range model that includes three stages: ethnic group formation, group interaction, and post-interaction identity change. (3) Implementation of model into agent-based simulation, using bounded optimization techniques to determine ethnic group boundary, action, and identity choices. (4) Completion of constructionist ethnicity dataset that describes demographic, cultural, and socioeconomic characteristics of ascriptively defined groups around the world. (5) Development of web crawler to locate virtual communities and to extract their attitudes using social network, content analysis, and social statistical methodologies. (6) Testing of assumptions of model through computer-mediated experiments involving formal games and field experiment on multi-ethnically divided population. (7) Testing of predictions of model through ethnic case studies, comparative cultural analysis, and cross-national conflict analysis. (8) Successful execution of 2 workshops which brought together for the first time prominent figures from the social and natural sciences communities working on common topics such as interpreting meaning and intent from textual content analysis and predicting behavior.

EXECUTIVE SUMMARY

The CCPV project developed novel cultural modeling technologies and a corresponding agent-based simulation system that predicts levels and types of political conflict throughout different regions of the world. The modeling technologies build upon the integration a full range of cutting-edge social science theories of attitude change and behavior, including endogenous cultural change, identity group boundary formation, and incorporation of individual choice in collective conflict and cooperation. Cultural change and boundary formation analyses include the grid-group framework, the most prominent general framework for representing cultural differences in social anthropology, as well as the coherence model, the first general predictive model that can predict cultural change, and more specifically changes in distributions of beliefs and values among different populations, based upon the past history of these populations. These theories are incorporated in a way that allows integration into a novel choice-theoretic, purposive behavioral model that incorporates both cooperative and non-cooperative game theory. Testing has been done using computer-mediated and field experiments that test the assumptions of the models and their general behavioral predictions across different cultures, as well as retrospective analyses of model predictions regarding the relationship between cultural variables, behavior, and event data. Among these experiments were those that examined the behavior of multicultural populations using the Hawai`i International Laboratory for the Computer-Mediated Study of Culture, as well as a field experiment in the Philippines that compared the levels of discrimination across religions and language among Mindanao-origin populations using precise quantitative measures.

In order to populate the structural and cultural parameters of these models with real-world data, it is necessary to collect new kinds of data that can be used to gauge the shifting patterns of cultural orientations, particularly ethnic identity, that exist in the world. A novel cultural dataset containing the demographic, socioeconomic, and cultural attributes of both latent and active ethnic groups worldwide was generated. The data has been publically archived and downloaded over 1,000 times. However, as the universe of groups that are being analyzed expands and policymakers require accurate responses quickly, new data-collection methods must be developed that can generate a dataset that meets a user's needs in an automated fashion, rather than relying on traditional methods that depend on human workers and judgment. Towards this purpose, as well as the more specific one of providing cultural data suitable for our models, a new kind of information search technology that generates attitudinal, demographic, and lifestyle data for any arbitrary group using data available on the internet and otherwise stored in hyperlinked format was developed. The methods involve applying established general, formal social theories of attitudes and behavior to network, content, geographical, and technical data to identify the virtual communities that correspond to the group of interest, then to analyze this community to extract its prevailing attitudes and lifestyle orientations across a wide variety of dimensions. This has resulted in technology combining general-purpose virtual community web crawling, real time content and structure processing, and specialized tools that extract information that are available from specific site genres such as forums, twitter, etc.

Combining these technologies together into an integrated platform has provided a genuinely new paradigm in information collection and processing, one that allows real world data to be

generated and the most relevant contemporary social theories to be applied to them in an unprecedentedly short period of time, thus making it possible for decision-makers without extensive technical training to utilize expert social science knowledge to generate realistic alternatives and solutions to address emerging world situations without having to wait for the long period of human data collection and analysis that traditional social science has required, nor to rely on unproven techniques simply because they are easier to implement for short turnaround decision-support.

Publications, papers and presentations as a result of this project are listed starting on page 23.

Project Personnel

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BACKGROUND

During the latter part of the 20th Century, there was a major shift in the type of political violence from primarily conflict between nation-states to primarily fighting among different ethnic groups within and across national borders. Current major conflicts such as those in Afghanistan, Somalia, Iraq, and Sudan are all ethnic-based. Even recent tensions/wars between nation-states such as India vs. Pakistan and Israel vs. various Arabian nations have an ethnic basis.   In order to protect its vital interests worldwide, the United States must understand ethnic violence: how ethnic identities arise and shift over time, what factors influence ethnic violence, and finally how it can be controlled or mitigated.

The effective long-term prediction of collective action within culturally diverse human populations has long been hampered by the lack of (1) a general model of cultural change that generates determinate, accurate predictions across a variety of environments, and (2) a flexible, yet powerful methodology for extracting and representing cultural information from a variety of empirical sources.

This project was a major step in developing some of the basic science to better understand ethnic violence. In developing a prototype computer-based simulation of ethnic violence, it was critical to substantiate and integrate the most important theoretic issues in predicting ethnic violence. This report details the state-of-the-art advancements in some of the areas in understanding ethnic violence with the eventual goal of predicting ethnic violence.

PROJECT OBJECTIVES

The following main tasks were defined for this project:

1. **Construction of the Cultural Model**
   Major cultural attributes and general assumptions about cultural change among individuals and groups in interaction with political and economic structure will be generated in operational form using Grid-Group framework for culture representation and the Coherence model of cultural change. Specific assumptions about cultural subattributes relating to group allegiances and human rights ideologies will be included.

2. **Identification of Cultural Materials and Validation of Cultural Coding by Area Experts**
   Experts on world regions will identify ethnographic sources of text information on cultures, language concordances used in natural language processing. Focus will be on a limited set of key cultures. Coding will be time-specific, and allow for sub-national distinctions. The experts will also examine codings on cultural values and beliefs from textual material in order to suggest corrections and refinements.

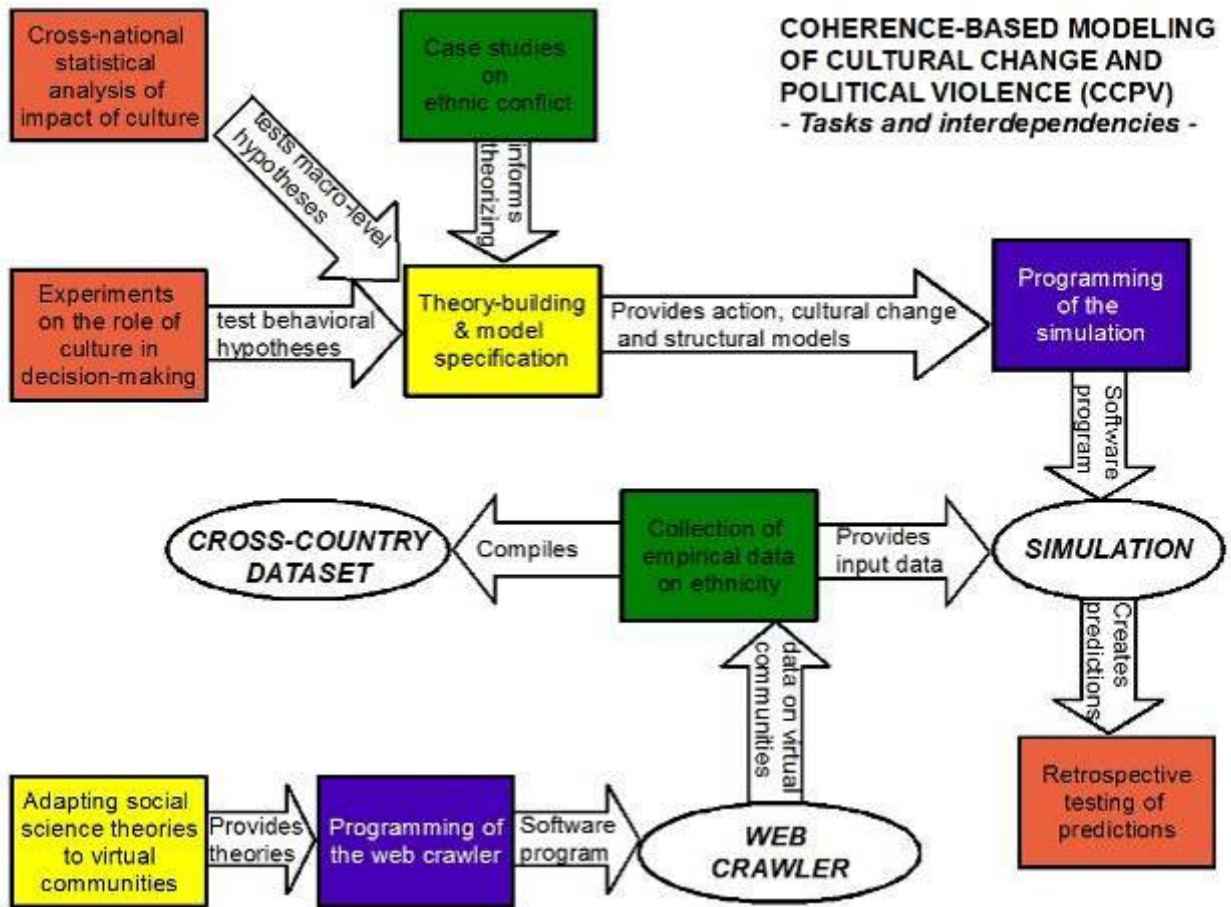3. **Implementation of the Model in Simulation Environment and Design of the Simulation User Interface**
   Computer scientists will lead development of an agent-based simulation environment including creation of avatars with cultural and decision-making attributes, graphic-rich Human-Computer Interface (HCI), and I/O system for loading of cultural, political, and economic categories and encodings.

   Expert knowledge of human-computer interaction will be applied to ensure that the system provides simple and convenient ways for users to specify the political scenarios they wish to examine, and obtain the depth of information that they require, from simple deterministic predictions to complex contingency diagrams. Techniques for modeling classes of users to customize interactions will be implemented.

4. **Development of a Web Crawler to Analyze Virtual Communities**
   This system will integrate social network and cultural theories from the social sciences into a software tool that is able to answer various kinds of research questions about the structure, culture and activities of virtual communities. The software is to be used primarily as a way for social scientists, business managers, government officials and other researchers and policy implementers to analyze the characteristics of the web virtual community, including a wide range of link, content, geographical, age, and popularity data about sites without manually exploring the sites themselves as well as the various public references on the internet relating to site characteristics.

Table 1: CCPV Project Overview

COHERENCE-BASED MODELING OF CULTURAL CHANGE AND POLITICAL VIOLENCE (CCPV)
- Tasks and interdependencies -

CONSTRUCTION OF THE CULTURAL MODEL

Ethnic identities may appear static in the short term, but in reality shift over time in response to cultural, economic, geographic and historical forces. For example, in Karachi, Pakistan, the prevalent ethnic identities pre-1947 were Hindu vs. Muslim, then shifted to Sindhi vs. Punjabi from 1947-1970s, followed by a shift in the 1980s to Sindhi vs. Muhajir and then a shift in the late 1990s to the current Sunni-Shi'ite divide. In South Africa, ethnic identity progressed from English vs. Afrikaners vs. Others to White vs. Black during the apartheid years. In Indonesia, the meaning of "Malay" has broadened over time. Even in the United States, Irish and Italian immigrants were not considered "white" for many years. Thus the first requirement in predicting ethnic violence is to first understand how ethnic identities develop and shift over time.

For the first step of modeling the cultural change and political violence, various datasets to check the relative grid-group situations for different countries will be used. Having generated the grid and group indices for each country, the ordinal indices were compared against the relative grid and group status. The results from various datasets can then be used to check the accuracy of the real culture difference.

Previous research finds controversial results in the use of attitudinal questions to predict behavior in the lab. In these experiments culture is conceptualized based upon the grid-group framework for representing general dimensions of cultural values, which introduced by anthropologist Mary Douglas [Do70], later by her work with Wildavsky [DW82]. Here ``group'' refers to the degree of solidarity (altruism) among members of a particular group (society, community). At the same time ``grid'' refers to the degree to which individual's behavior constrained by the norm and rules (strong reciprocity) of the group.

This "grid-group" framework is chosen because of its parsimony, the fact that it is probably the best-known formalized classification of cultures within the contemporary social science literature, and because its two abstract dimensions have been shown to be accurate predictors of numerous concrete cultural predispositions. While its two dimensions are deceptively simple, they also provide a systematic framework for organizing large numbers of more specific cultural attributes.

It is hypothesized that individuals from western cultures that are more individualistic (with low-groupness and low-gridness characteristics) will act in a more self-interested manner and would not penalize others at his/her own cost while a person from collectivist culture (with high-groupness and high-gridness characteristics) will act more altruistically toward others and will incur costs to punish others. The accompanying paper *"Grid-Group Variables in the Modeling the Cultural Change and Political Violence"* is attached as Appendix A.

The experiments conducted here differ from previous research in a way that a measure of an individual's preferences through the survey is provided. The grid/group measure [DW82] will not only explain an individual's behavior in the lab, but more importantly, draw a comparison between grid/group measure and collectivist versus individualist measures to predict the outcome. Note that in the grid/group framework individualistic culture is represented by low-grid and low-group characteristics.

220 subjects were provided with pretest surveys, which were used to generate measures for each subject along grid and group, two very prominent and general cultural dimensions drawn from social/cultural anthropology. Grid was hypothesized to induce enforcement of social norms of reciprocity, and group to induce altruism towards other individuals. These subjects were then placed in ten decision rounds of various games in a stranger setting. Overall, we find that the group (altruism) attribute was positively and significantly correlated with the level of offers in the ultimatum game. The lowest acceptable amount was greater for subjects with higher grid (reciprocity) attribute. The high grid (reciprocal) subjects were also more willing to punish (designate less dollars) in the convex version of ultimatum game. Besides grid/group measures, we employ an alternative cultural instrument, the individualism/collectivism score. It is found that the individualism score was negatively correlated with donations, while the collectivism score predicted trusting actions. The advancement made here is twofold. First, a methodology that uses general cultural dimensions to predict differences in behavior under widely varying conditions is created. Second, it is resolved that the distribution of cultural types in our subject pool reflects existing distribution of human types in social preference studies. The accompanying paper, *"Cultural Values and Behavior in Dictator, Ultimatum, Trust games: Experimental Study"* and presentations are attached as Appendix B, C and D.

Further analysis was conducted to outline the Grid/Group framework to demonstrate how a society deals with differences in power and hierarchy and with uncertainty and risk. The potential advantages of this alternative in explaining preference formation with a series of comparisons of the relative strengths and weaknesses of grid-group theory and the conventional cultural dimensions was examined. It is demonstrated how one conceptualization of culture, grid-group theory, overcomes aspects of some difficulties of other cultural dimensions and contributes to explaining institutional form and cultural change. While lack of empirical comparison data make results tentative, the Grid-Group framework retains the advantage of parsimony as the single most powerful predictor of culture change across a range of social and political issues. Grid-group theory unpacks distinct social logics that are conflated in traditional unidimensional models by reconceptualizing culture in a more powerful and useful form. These logics not only reveal more about the bases for persons' attitudes, they offer an explanation for the shifting structure of political conflicts and coalitions. Thus grid-group theory opens up into a diversity of selves who construct a variety of interests in the service of different ways of life (or cultures). The accompanying paper *"Cultural Dimensions and Grid-Group Theory: From Classification to Process"* is attached as Appendix E.

Another experiment measured subjects along grid and group cultural dimensions using survey questionnaires to predict variations in behavior in voluntary contribution mechanism (VCM) with and without punishment and bargaining experiments. Grid was hypothesized to induce enforcement of social norms of reciprocity, and group to induce altruism towards other individuals. Overall, it was shown that the group attribute was positively and significantly correlated with the level of individual contribution and offers. The grid attribute was positively correlated with willingness to punish, and significantly so for treatments where team membership was shuffled from round to round. Hence cultural type was shown to have a significant effect on

performance in games, contrary to predictions of conventional models. Results were made by combining laboratory experiments with a new methodology to measure cultural attributes, therefore social preferences. The survey focuses at its core on the novel objective to "determine which cultural factors are most statistically relevant as performance moderators". This is accomplished by incorporating the role of two cultural factors in particular, grid and group, the basis for perhaps the most prominent general framework for cultural classification in the social sciences. The accompanying paper, *"Grid/Group Cultural Theory and Behavior in Voluntary Contributions Public Goods and Bargaining Experiments"* and presentation are attached as Appendix F and G.

In addition, incentives are manipulated to predict preference change in public good experiments. 124 subjects were placed in ten decision rounds of modified VCM followed by the ten rounds of regular VCM. As predicted half of population exhibit state dependent preferences, i.e. contribute in the modified games and withdraw from public account in the regular game (institution-responsive type). Even though incentives reflected the rationality to contribute in the modified games and free ride in the regular game, there was a minority of subjects who remain not contributing in all states (non cooperator or free rider). Another minority kept contributing in all states (unconditional cooperator). Depending on whether the state is stochastic or not the percent of non cooperator and unconditional cooperators changes in a way that with more noisy and risky environment percent of non-cooperators increases while the percent of conditional cooperators remain stable. The risk preference measure reveals that about seventy percent of subjects are risk-averse. Cooperators turn out to be more risk seeking than other behavioral types. Risk-averse people contributed less in the regular games. Further, the group (altruism) attribute was positively and significantly correlated with the level of contributions in the modified VCM. Cooperators and institution-responsive types have higher group and higher grid scores whereas non-cooperators have low scores in both dimensions. This result again validates the designed survey measure that correctly predicts individual differences with respect their behavior. The accompanying paper, *"Endogenous Preference Change and Group Behavior in Experiments"* is attached as Appendix H.

IDENTIFICATION OF CULTURAL MATERIALS AND VALIDATION OF CULTURAL CODING BY AREA EXPERTS

In this part of the CCPV project, data was collected from various sources and constructed a cross-country dataset on ethnic minorities. This dataset is unique in social sciences in that it includes data on "latent" groups - i.e. groups that share ascriptive characteristics but may have not as of yet engaged in any observable political action/organization. The ascriptive characteristics used for group identification are the primary spoken language, religion, geographical-historical origin, and race. The algorithm used to identify groups to be included in the dataset is described in the *"Manual for CCPV Cross-country Ethnicity Dataset",* Appendix I. The data collected include population, income, wealth, education, urbanization and labor force data, and also country-expert subjective assessment of the group's power in various spheres. The data is publicly available through Harvard's dataverse project at: http://hdl.handle.net/1902.1/14465.

To complement the dataset, several more experiments were conducted including those based on dictator, ultimatum bargaining and trust games. These have been used ubiquitously in economic experiments to study other-regarding behavior. While altruism, reciprocity and preference for fairness are the most discussed explanations for other-regarding behavior in such games, the origins of such tastes may lie in cultural values. The behavior may be further affected by experimental design choices on whether subjects play a game in both roles, or just in one role. While some studies adopt the role reversal setting and others do not, the effect of this variation in design is still not well understood.

Considering the significance of cultural values along with the role reversal effects in a unified study using dictator, ultimatum bargaining and trust games, economic laboratory experiments consisted of two parts. In part 1, individual cultural values using a survey instrument based on World Values Survey (WVS) were measured. In part 2, cultural values are correlated with behavior in experimental games. Two main treatments included experimental subjects playing either just one role (e.g., only the dictator in the dictator game), or both roles (e.g., both dictator and the recipient in the dictator game.)

The aggregate behavior was somewhat different across the one-role and two-role treatments, but not in all roles and all games. Importantly, cultural variables had a more pronounced effect on behavior in the two-role treatment. The accompanying paper *"Playing Both Roles: Role Reversal Effects and Culture in Simple Games"* and presentations are attached as Appendix J and K.

To further the database and validate reached conclusions, field experiments were conducted in the Philippines to examine (1) whether Muslims and Christians differ in their economic behavior such as risk attitudes, time discounting and contribution to public goods; and (2) whether there are patterns of in-group favoritism and out-group discrimination among the two religions and various ethno-linguistic groups in the Philippines. The field experiments were conducted in September-October 2009 with a total of 305 participants. The experimental design features a sample from two religions, Islam and Christian, and the major ethno-linguistic groups in the country. The experiments were carried out in three areas in Metro Manila with established Muslim settlements.

Results show that there is no significant difference between our Muslim and Christian participants in terms of risk attitudes and time preference. The Muslim participants, particularly those from the lowest income community among our locations, tend to send higher contributions to the public funds than their Christian counterparts. Generally, the collected data showed no sign of religious or ethnic in-group favoritism as evidenced by the amounts sent to a stranger in our four variants of the dictator game. However, when disaggregated by location, the data shows slight in-group favoritism among the lowest income and highly segregated Muslim community. It appears that there is no strong evidence of in-group favoritism and out-group discrimination that follows religious or ethnic divide. The level of assimilation and degree of a community's segregation may have an impact on the in-group/out-group bias. One important caveat is that the experiments were conducted in relatively peaceful Muslim communities in Manila and not in the conflict zones of Moro Mindanao.

The results, however, bodes well for possible policies for negotiating peace among the conflicting regions in the South. Migrant Muslims in Metro Manila behave similar to their Christian counterparts and there is no strong evidence of in-group/out-group biases. Thus, modes of assimilation such as communication and contact among groups may have positive effect on peace negotiations. The accompanying paper, *"Does Religion and Ethnic Identity influence Social Preferences? Evidence from Field Experiments in the Philippines,"* and presentation are attached as Appendix L and M.


Above: Philippines Field Experiment

IMPLEMENTATION OF THE MODEL IN SIMULATION ENVIRONMENT AND THE DESIGN OF THE SIMULATION USER INTERFACE

Given a set of ethnic coalitions, our simulation software must determine how much resources each coalition is willing to devote to conflict (or equivalently to conflict preparedness in case conflict does not occur), determine the likelihood of violent conflict, and finally the likelihood of winning the conflict should it occur. The result of any conflict or cooperation within or across ethnic groups changes the altruism of each ethnic group, which feeds back to influence the likelihood of future ethnic identity shifts. For example, in South Africa, the formation of the White ethnic identity was delayed because of lingering resentment (negative altruism in our model) between the English and Afrikaners due to their conflict in the Boer Wars.

BASIC PATH OF SIMULATION MODEL
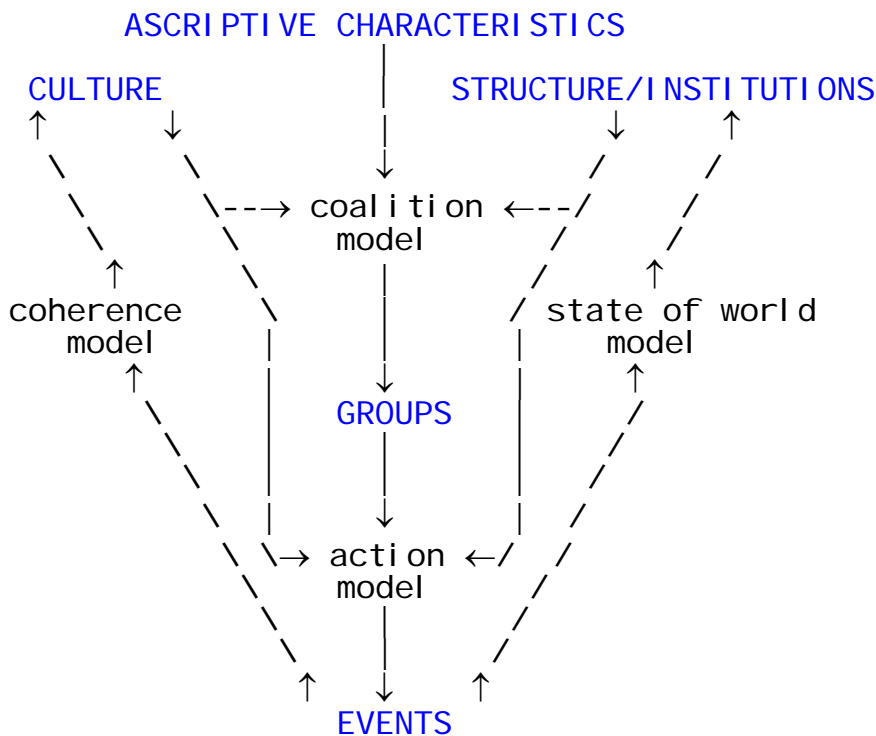
This project advanced the state-of-the-art in modeling how altruism is affected by conflict (this affects how ethnic groups feel toward each other and hence how likely they are to form an ethnic coalition). Also, a game-theoretic model was developed of how much resources each ethnic coalition should devote to conflict and a solution method using gradient ascent.

The first component of the simulation model predicts how different agents with different cultural characteristic (e.g. language, religion) would form coalitions when competing for a resource. The social planer inputs the matrix of externalities based on experiments and other observable variables, and the software outputs the formation of coalition using a tournament game and one

of stability notions selected discussed above. The accompanying paper *"Tournament Games with Externalities"* is attached as Appendix N.

In order to achieve this prediction, the project introduces a novel theoretical model of coalition formation when externalities. Specifically, when agents are endowed with a level of power (e.g. political or military) and form coalitions with other agents in order to win a prize. Such games have important applications, for instance in political contests or military wars.

The main concern was to construct equilibrium notions that accurately predict which coalitions form when agents are endowed with certain power and also have externalities toward other agents. These problems often occur in political contests, where parties tend to form coalitions with other parties of similar ideologies rather than forming the grand coalition. Alternatively, externalities might be interpreted as altruism generated by cultural characteristics such as race, language, religion or ancestral homeland (e.g. when there is homophily). The project introduced and programmed three equilibrium notions: CORE, Merge-Proof and Split-Proof (MPSP) and No-Threat Equilibrium (NTE). The accompanying paper *"Computing Coalitions"* is attached as Appendix O.

The second component of the simulation model involves the development of conflict models. Several analytical models address why a war can occur despite its cost in bilateral contexts. The accompanying paper *"Models of Ethnic Conflict"* is attached as Appendix P. Rational Choice Theory holds that the causes of rational wars are three-fold: (i) issue indivisibility; (ii) commitment problem; (iii) asymmetry of information. Incorporating these insights, an analytical model toward a dynamic-repeated fashion is developed.

While political conflicts have been extensively studied by scholars of International Relations, criminal conflicts have been much less focused especially by theorists in the field. With specific focus on the latter type of conflicts, why an individual crime across an ethnic or tribal border often leads to large-scale violence is addressed. Along rational choice perspectives, three hypotheses which might explain this puzzle are examined: (i) Avengers penalize any suspects in the culprit's social group, because they cannot identify the culprit; (ii) Avengers seek a vicarious punishment on the culprit's significant others, because the vicarious punishment can be more painful for the culprit than a penalty just on himself; (iii) By demanding collective responsibilities, avengers induce an internal control of the culprit from his peers. Historical incidents and recent case studies suggest the third to be most appealing. The accompanying paper *"Criminal conflict as collective punishment"* is attached as Appendix Q.

An events dataset was also constructed to feed into the models. Their utilities were calculated by the conflict model, which was a part of the system of models, and there was no need to input the utilities manually. Indeed, the utilities attached to participating in an event depended upon the individuals, which side they were on, and their structural/institutional conditions, so there is no single utility of joining or not joining attached to an event.

Also, for each individual, the utilities of each possible action were represented by a probability function, since a priori outcomes were uncertain. Because of this, there was no need for a

separate "clear/risky" variable, since riskiness can be inferred from the variance of the probability function.

The choices available to individuals themselves depended on the structural/institutional conditions, particularly on political institutions. While in an anarchy or extreme autocracy, it was more plausibly assumed that the main options for action between members of contending groups were binary – violence or no violence. However, in a more democratic society, there was an additional choice or choices associated with competition within the bounds of democratic rules.

This project built upon and expanded the PI's coherence model [C01], the first general, predictive endogenous model of cultural change. Although the coherence model was originally developed as a computational model, it had never before been implemented in software. As a result there were many underspecified portions of the theory that were not apparent until we were forced to code it in our simulation software. A crucial theoretical advance is the development of a game-theoretic model of coalition formation and stability.

First, we developed a set of mutually exclusive and exhaustive coalitions $c \subset \Omega$, where coalitions themselves are made up of one or more ascriptively defined groups, i.e. all c were the union of some set $\{Q_{\rho 1}, Q_{\rho 2}, \ldots\}$ of such groups. At each decision point, there was a "conflict choice". Each coalition has some level of power $\pi_c = \sum_{i \in c} \pi_i$. In each period, the coalition chose to expend either zero or its entire power endowment π_c to participate in a generic conflict. The probability for any coalition of winning the competition was $p_c \equiv \theta_c / \sum_{d \subset \Psi} \theta_d$, where Ψ was the set of all c's, and $\theta_c \in \{0, \pi_c\}$ was the amount of power expended in the conflict.

The winner of the conflict ended up with some percentage $0 < \lambda < 1$ of the entire post-conflict power endowment all of the other coalitions, plus their entire own remaining endowment. Each coalition's power endowment was reduced by some percentage $0 < \varphi < 1$ of the amount of resources they expended in conflict. So if coalition c was the winner and x_c was defined as their payoff, then $x_c = (1-\lambda)(\pi_c - \varphi \theta_c) + \lambda \sum_{d \subset \Psi} (\pi_d - \varphi \theta_d)$. Each amount that was awarded to the winning coalition is subtracted from endowment of the other coalitions, so each losing coalition had a payoff of $x_c = (1-\lambda)(\pi_d - \varphi \theta_d)$. The power distribution for the next conflict reflected these results, plus a "natural growth" factor $f > 1$. Hence if π_{c+} represented power for c in the next period, then $\pi_{c+} = f x_c$. Within coalitions, payoffs were distributed to individuals proportionately to the power each individual had, regardless of how much the individual expended during the conflict. Hence $x_i = (\pi_i / \sum_{i \in c} \pi_I) x_c$.

It was assumed that the decision to engage in conflict was made according to a collective expected utility function that reflected the individual utility functions weighted by the relative power of each individual, i.e. $u_c = \sum_{i \in c} \pi_i u_i$. Once a decision was made, it was assumed that all individuals in coalition contributed their entire power endowment to the conflict. Of course, since θ_d was exogenous for all $d \neq c$, standard game theoretical methods was used to identify the equilibria. In this version, the model did not take into consideration or generate predictions about changes in structural factors other than relative power.

For this two-choice game, expected regret existed across the population unless λ was so low that not engaging in conflict provided higher utility with certainty for some coalition.   There were a number of ways in which the altruisms were changed to restore expected regret for this action to zero, such as reductions in the λ or all individuals not in the coalition. If victory occurred but the individual's share does not justify participation, then λ was increased for individuals in the coalition. Accompanying papers *"A Multi Player Conflict and Distribution Model"* and *"Coherence Model Applied to Aftermath of Coalition Interaction"* are attached as Appendix R and S.
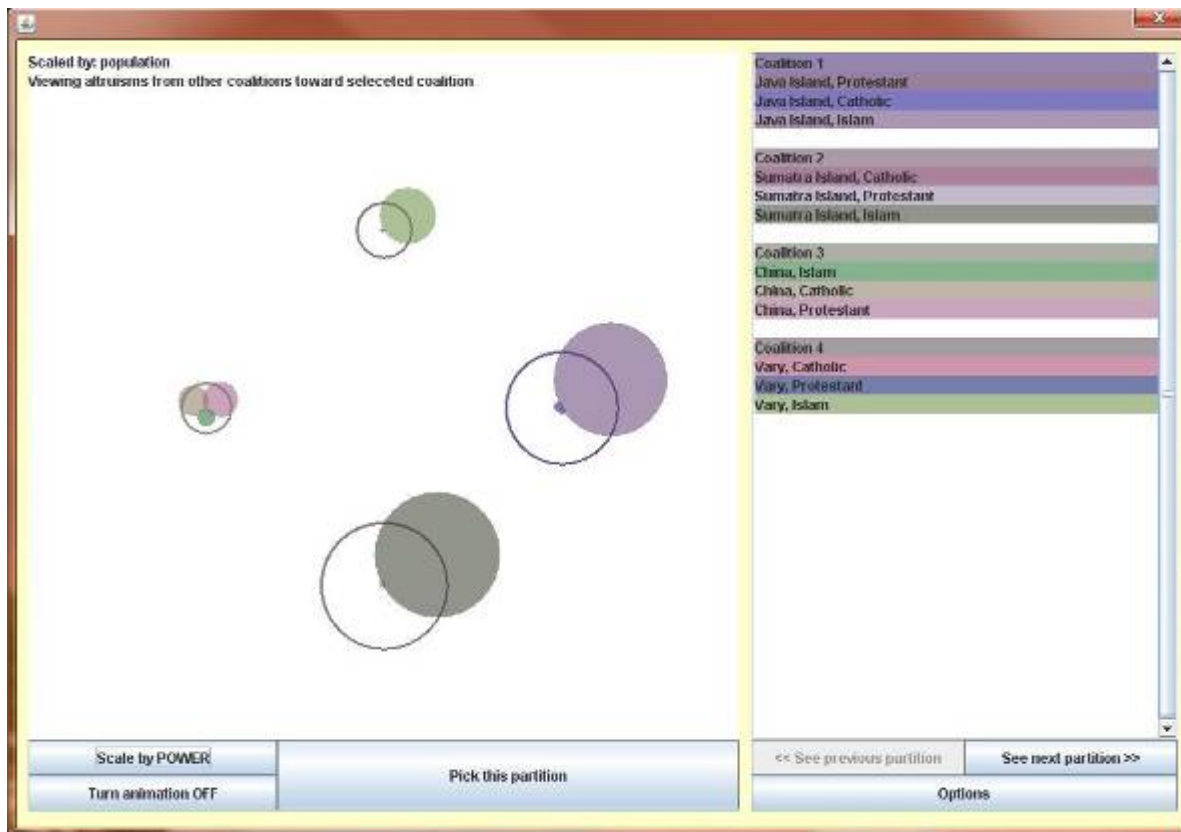
Above: The coalition forming screen
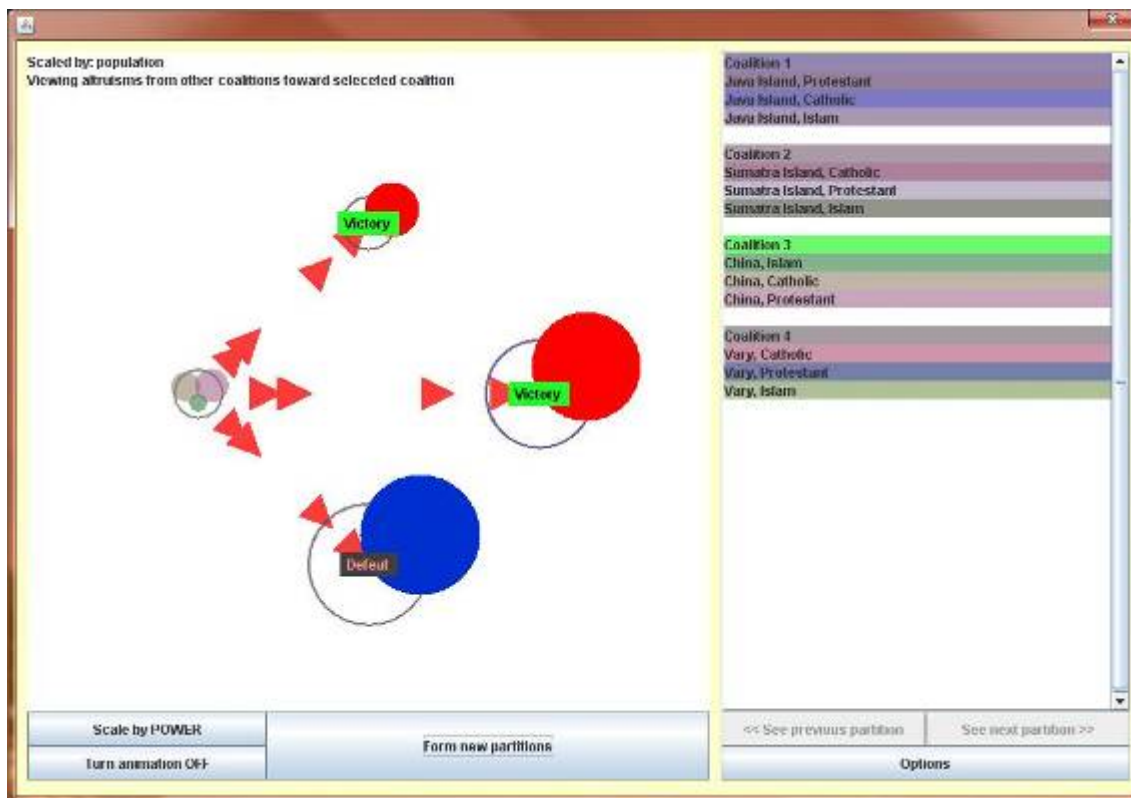
Above: The conflict screen showing post-conflict altruism
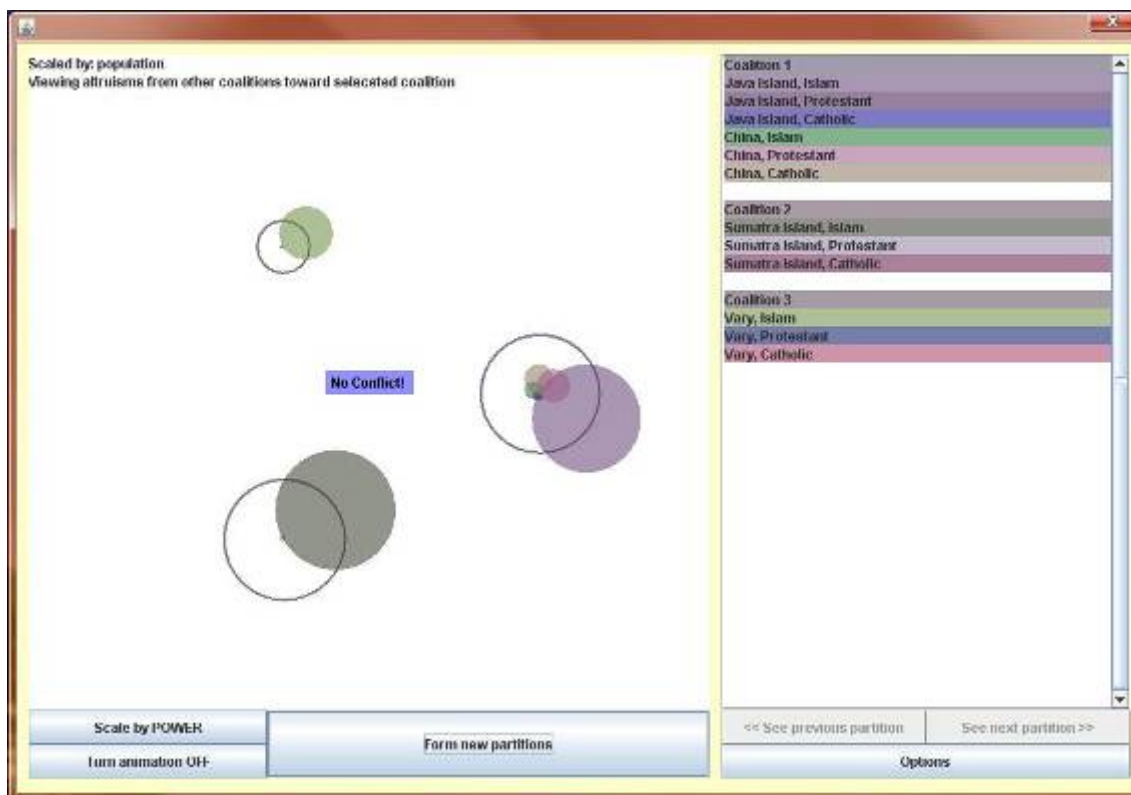
Above: No Conflict with New Coalitions screen

DEVELOPMENT OF A WEB CRAWLER TO ANALYZE VIRTUAL COMMUNITIES

An important input for our theory is how ethnic groups feel towards each other (altruism). Such data is not available in any public datasets and is very difficult to gather as it requires interviewing multiple members of each ethnic group using appropriate sampling techniques. In areas of current ethnic violence, it may be impossible or at least very difficult and/or dangerous to gather such data. To address this problem, we have developed an algorithm for searching the Web to find groups and then assessing their altruism toward other members of their own group (groupness in the Grid-Group framework [Do70, Do89, DW82, CW94, CS98]). This algorithm was recently awarded a patent and we have implemented the algorithm in the CLAS$IC software program for finding virtual communities.

CLAS$IC allows non-expert users to locate and analyze virtual communities on the World Wide Web. It employs a configurable crawling algorithm based on social science network theories and content analysis to automatically locate a virtual community of interest to the user, identify key sites within the community, determine communications patterns, and provide a large set of quantitative and qualitative information about the community that can be configured by the user. The software tool employs crawling at an intrasite and intersite level, for determining which types of network, content, and other measures will be used as criteria for inclusion in the virtual community. The virtual community data obtained by crawling are saved in standard file formats to enable further research on virtual communities of websites using third party software.
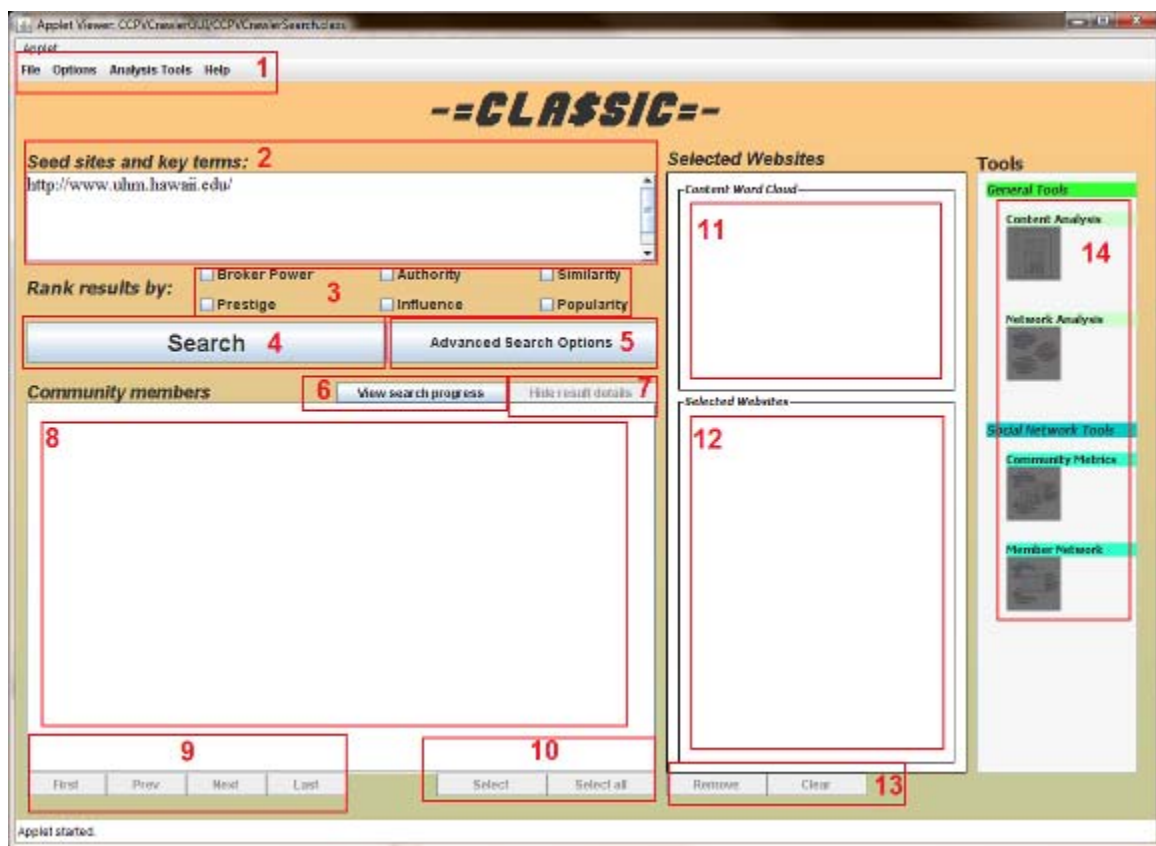
Above: The general web crawler interface
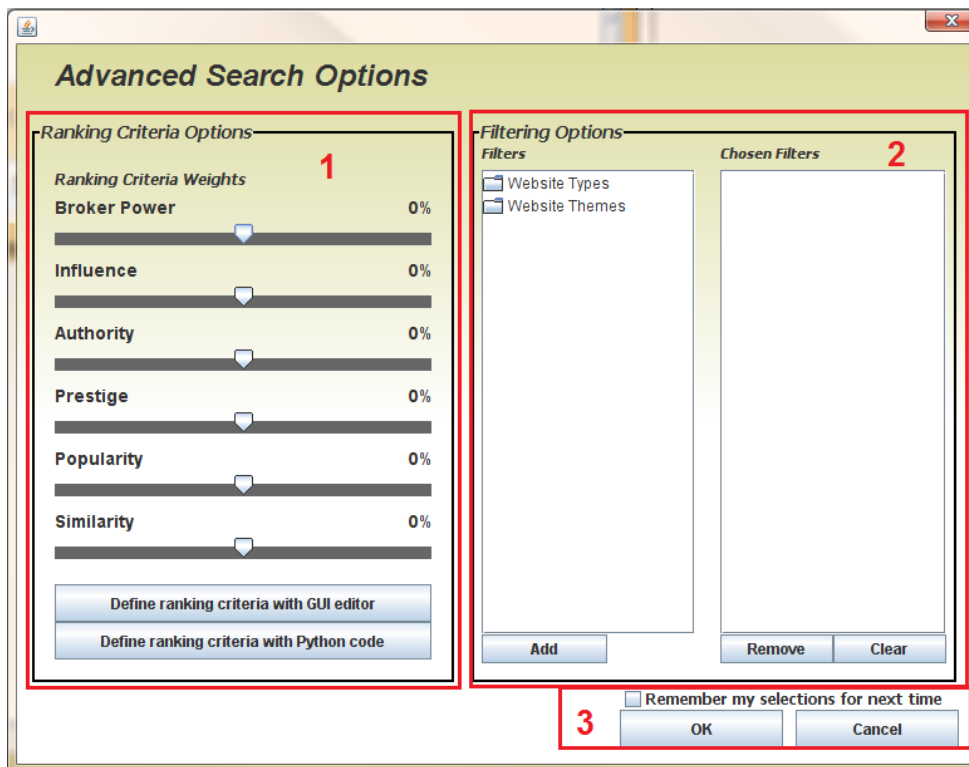
Above: Advanced searching options including Influence, Authority and Prestige
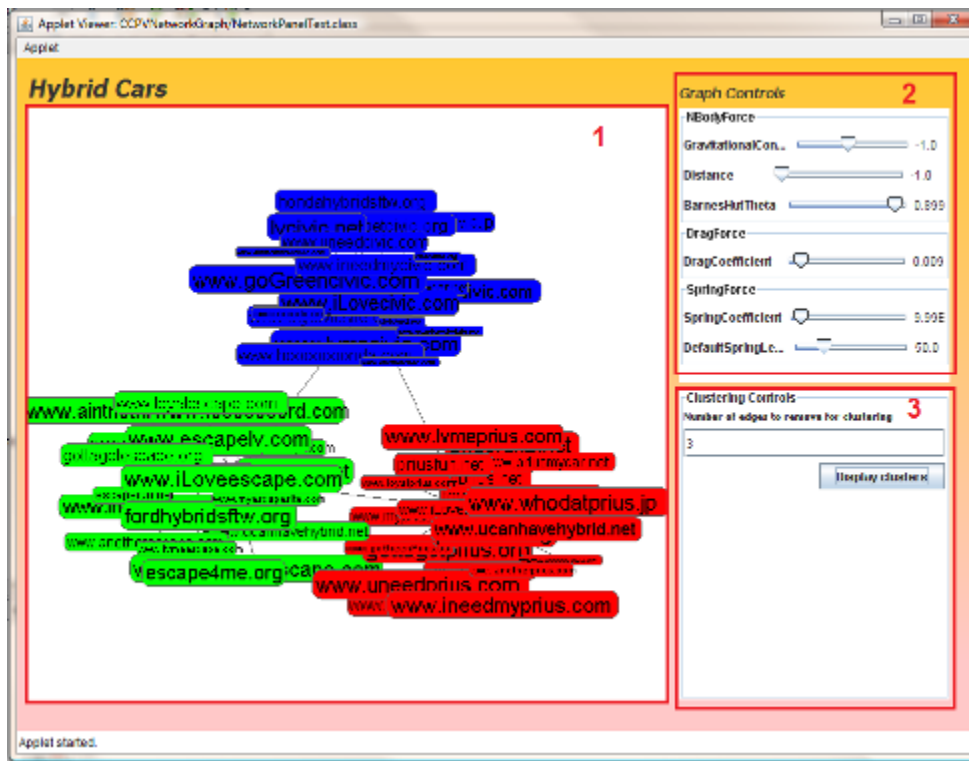

Above: Network Analysis showing communities as defined by specified crawling algorithms

Since the remarkable success of PageRank, much research has been performed on designing better and better static heuristics for the 'goodness' of a website. These algorithms are often benchmarked against each other in various, indirect ways, as access to a large set of websites that have been ranked by their importance in relation to arbitrary topics or keywords by actual humans is difficult to obtain. In addition, the implementation of any particular algorithm can be a quite arduous task, especially when multiple heuristics are combined to produce better results. PageRank, though perhaps the most popular static ranking algorithm, is far from the best. Other static algorithms such as fRank show a marked improvement, while other new metrics such as SocialPageRank and topic-based PageRank produce better results when either the metadata for the algorithm is present for the site, or the site belongs to one of several, pre-computed categories handled by the algorithm. In these cases, it follows that the more specific a user is on what he is looking for, the more specialized the algorithm itself must become in order to return relevant, tailored results.

The state of the art is advanced by implementing a method of rapidly prototyping website ranking algorithms by implementing a generic crawler with a plugin architecture for describing user-defined 'properties' of websites, as well as a language by which the properties can be used to produce a ranking for a particular site. This modular way of defining the ranking criteria of a website can also be used to provide custom search strategies for different search needs. This system is then leveraged to find 'communities' of websites: That is, websites that are related in a way described by a user-submitted heuristic involving the aforementioned properties. The same seed website is used several times, varying the heuristic to demonstrate how a many different communities can be discovered using this method. The user manual for the crawler is attached as Appendix T.

Specialized forum and Twitter analyzers have also been developed to complement the general crawler. Forums, due to its logging and organization of posts, threads and topics, provide a unique platform to gather and analyze data on a level unavailable in general websites. The forum analyzer has been able to derive reply rates, lurker rates, centrality levels and other metrics to assess member participation and intra-member relationships. Similar metrics have also been developed for the specialized Twitter analyzer. The accompanying paper *"Development of Forum Analyzer and Twitter Analyzer"* is attached as Appendix U.
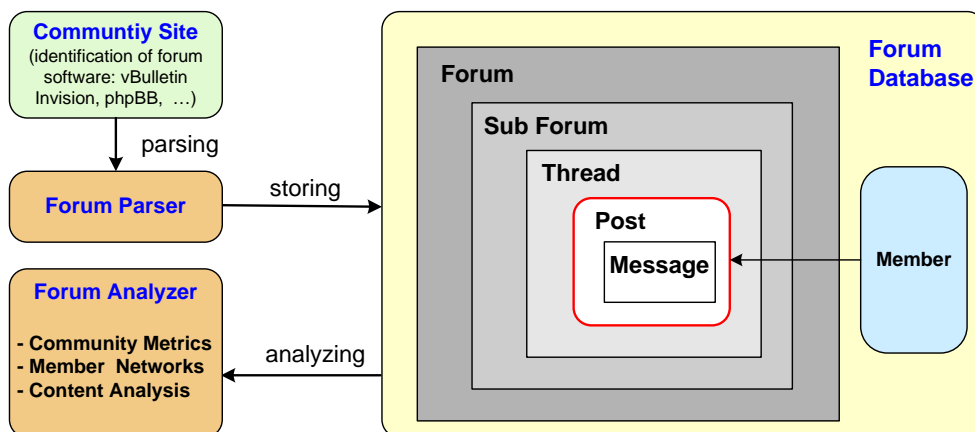
Above: The Forum Analyzer's Architecture

Above: The Forum Analyzer User Interface
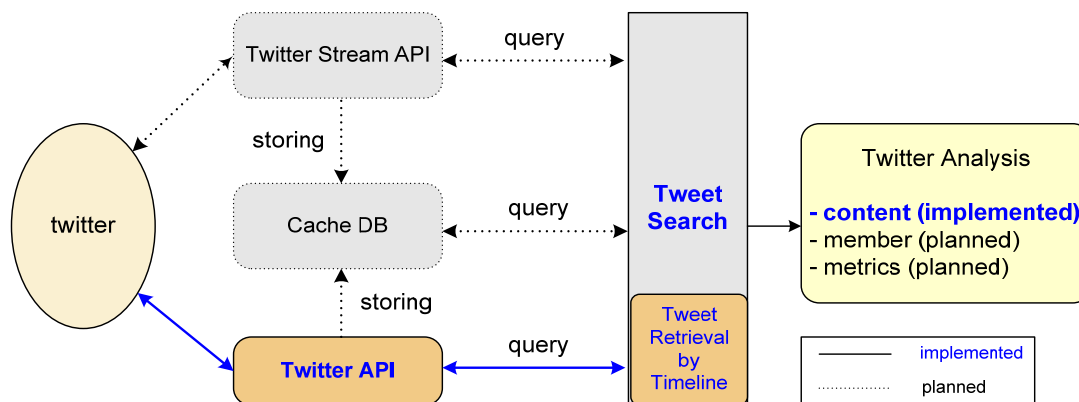
Above: The Twitter Analyzer Architecture
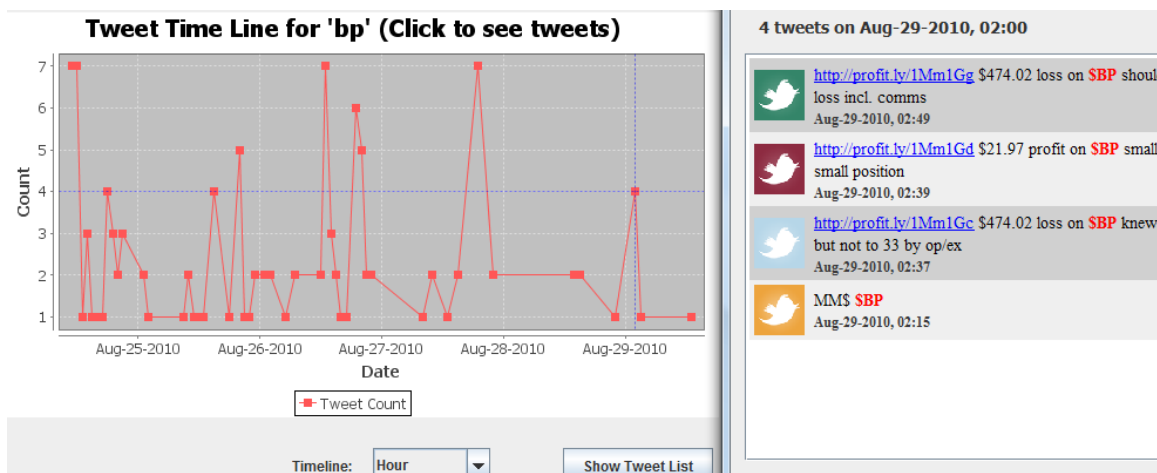
Above: Twitter Analyzer Tweet Timeline display

References

[C01] Chai, Sun-Ki. *Choosing an Identity: A General Model of Preference and Belief Formation* (Ann Arbor, MI: University of Michigan Press, 2001.

[CS98] Chai, Sun-Ki and Brendon Swedlow (eds.), *Culture and Social Theory* (New Brunswick, NJ: Transaction Publishers, 1998).

[CW94] Chai, Sun-Ki and Aaron Wildavsky, "Culture, Rationality and Violence". In Dennis J. Coyle and Richard J. Ellis (eds.), *Politics, Culture and Policy: Applications of Cultural Theory* (Boulder, CO: Westview Press, 1994).

[Do70] Douglas, Mary, *Natural Symbols: Explorations in Cosmology* (New York: Pantheon, 1970).

[Do89] Douglas, Mary, *In the Active Voice* (London: Routledge and Keegan Paul, 1989).

[DW82] Douglas, Mary and Aaron Wildavsky, *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers* (Berkeley: University of California Press, 1982).

PUBLICATIONS, PAPERS and PRESENTATIONS

Authors:	Chai, Sun-Ki
Title:	Theories of Culture and Action
Status:	Forthcoming in Ian Jarvie and Jesús Zamora-Bonilla (ed.),*The Sage Handbook Of The Philosophy Of Social Science* (London, Sage Publications, 2011).

Authors:	Chai, Sun-Ki
	Liu, Ming
	Kim, Min Sun
Title:	Cross-Culture Comparison: the Grid-Group Approach
Status:	Published in *Beliefs and Values,* 1:2 (2009), 193-208.

Authors:	Chai, Sun-Ki
	Rhee, Mooweon
Title:	Confucian Capitalism and the Paradox of Structural Holes in Asia
Status:	Published in *Management and Organization Review,* 6:1 (March 2010), 5-29

Author:	Noble, Cecilia
Title:	Moderation and Radicalism in Moro Land
Status:	Published in *Islam and Democracy Journal of the University of Asia and the Pacific* (April 2010).

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Authors:	Chai, Sun-Ki
	Dorj, Dolgorsuren
	Hampton, Kyle
	Liu, Ming
Title:	Grid-Group Cultural Theory and Behavior in Computer-Mediated Experiments
Status:	Presenting at Workshop on Human Brain and the Social Bond, Vienna, September 3-4, 2010

Authors:	Chai, Sun-Ki
	Dorj, Dolgorsuren
	Liu, Ming
	Kim, Min Sun
	Sherstyuk, Ekaterina
Title:	Cultural Values and Behavior in Dictator, Ultimatum, and Trust Games
Status:	Pending. Target publication: Journal of Economic Behavior and Organization

Authors:	Chai, Sun-Ki
	Dorj, Dolgorsuren
	Liu, Ming
	Sherstyuk, Katherina

Title: Endogenous Shifts Over Time in Patterns of Contributions in Public Goods Games
Status: Pending

Authors: Chai, Sun-Ki
Dorj, Dolgorsuren
Liu, Ming
Sherstyuk, Ekaterina

Title: Playing Both Roles: Role Reversal Effects and Culture in Simple Games
Status: Pending. Target publication: Experimental Economics

Authors: Chai, Sun-Ki
Eckel, Catherine
Gundaya, Deborah
Noble, Cecilia
Sherstyuk, Katherina
Wilson, Rick

Title: In-group and Out-group Distinction in Field Experiments among Philippines Muslim Communities
Status: Pending

Authors: Chai, Sun-Ki
Liu, Ming
Kim, Min Sun

Title: General Cultural Dimensions and Political Development: An Evaluation of the Grid-Group Index
Status: Pending

Authors: Chai, Sun-Ki
Rhee, Mooweon

Title: Exploring the Network Structure of Virtual Communities: A Web Structure Analysis of a Korean-American Community
Status: Revise and Resubmit at *Social Networks*

Author: Chu, Kar-Hai
Chin, David
Chai, Sun-Ki

Title: Searching for web communities through site level link and content analysis
Status: Pending

Author: Herres, Aaron
Title: Modification of search "in-flight": Using a closed-loop learning process to guide non-intuitive search
Status: Pending. Target Conference: ACM Conference on Human Factors in Computing Systems Conference

Author: Kumar, Shamanth
             Kang, Dong-Wan
             Herres, Aaron
             Chin, David
             Liu, Huan
             Chai, Sun-Ki
Title: Integrated Applications for a General Crawler, BlogTracker, and Forum Analyzer
Status: Pending

Author: Khan, Abdul-Karim
Title: The Sin of Ethnicity Against State and Religion: The Case of Pashtun Ethno-Nationalist Separatism as Perceived Against Pakistan and Islam
Status: Pending

Authors: Liu, Ming
             Chai, Sun-Ki
             Kim, Min Sun
Title: Cultural Indicators of Economic Development: Comparison between Hofstedes' Cultural Dimensions and the Grid/Group Index
Status: Pending

Author: Noble, Cecilia
Title: Constructing the Moro Identity: A Content Analysis of Moro Websites
Status: Pending

Author: Noble, Cecilia
Title: Ethnic Identity Evolution and Mobilization: The Bangsamoro Case (of Southern Philippines)
Status: Pending. Target Conference: The Biennial Conference of the Canadian Council for Southeast Asian Studies

Author: Noble, Cecilia
Title: The Bangsamoro Struggle for Self-Determintation: A Case Study
Status: Pending

Authors: Noy, Ilan
             Shayo, Moses
Title: Dominant Minorities and Income Distribution
Status: Pending

Authors: Rhee, Mooweon
             Kim, Tohyun
Title: Identity, Networking and Partitioning
Status: Pending

Authors: Rhee, Mooweon
             Chai, Sun-Ki
             Kang, Dong-Wan
Title: Communication Pattern, Network Structure, and the Growth of Virtual
             Organizations
Status: Pending. Target publication: Organization Science

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Bangsamoro Ethnic Identity: Evolution and Transformation
Presented by Noble, Cecilia
Naval Postgraduate School CORE Lab; Monterey, CA; April 2009

The CLASSIC Web Crawler
Presented by Chai, Sun-Ki
Social Network Mining Research Centre, Singapore Management University; Singapore; June 2010
School of Convergent Science and Technology, Seoul National University; Suwon, Korea; June 2010

Coherence Model of Preference and Belief Change
Presented by Chai, Sun-Ki
ACM International Workshop on Social Computing, Behavioral Modeling and Prediction; Phoenix,
AZ; March 2009

Communication Pattern, Network Structure, and the Growth of Virtual Organizations
Presented by Rhee, Mooweon
INSNA-Sunbelt Networks Conference; Trento, Italy; March 2010
Academy of Management; Montreal, Canada; August 2010
American Sociological Association; Atlanta, GA; August 2010

Cultural Values and Behavior in Dictator, Ultimatum, and Trust Games
Presented by Sherstyuk, Katherina
Rationality, Behaviour and Experiments Conference; Moscow, Russia; June 2009
Economic Science Association (ESA) International Meeting; Washington DC; June 2009
ESA Asia Pacific Meeting; Melbourne, Australia; February 2010

A Formal Cultural Model of the Structural-Hole Thesis
Presented by Chai, Sun-Ki; Rhee, Mooweon
American Sociological Association Annual Meeting; New York, NY; August 2007

Grid/Group Cultural Theory and Behavior in Computer-Mediated Experiments
Presented by Chai, Sun-Ki
Fourth Joint Japan-North America Mathematical Sociology Conference; Redondo Beach, CA; May
2008

Hawaii Sociology: Past, Present, and Future
Presented by Chai, Sun-Ki
Hawai`i Sociological Association Annual Meeting; Honolul, HI; February 2010

Moderation and Radicalism in Moro Land
Presented by Noble, Cecilia
Center for Philippine Studies, University of Hawaii; Honolulu, HI; March 2009

The Next Steps in Mathematical Sociology
Presented by Chai, Sun-Ki
American Sociological Association Annual Meeting; Atlanta, GA; August 2010

Playing Both Roles: Role Reversal Effects and Culture in Simple Games
Presented by Sherstyuk, Katherina
Economic Science Association (ESA) North American Meeting; Tucson, AZ; November 2009

Rational Choice Theory: A Forum for Exchange of Ideas between the Hard and Social Sciences in Predictive Behavioral Modeling
Presented by Chai, Sun-Ki
ACM International Workshop on Social Computing, Behavioral Modeling and Prediction; Phoenix, AZ; May 2008

The Social Science Approach to Web Mining
Presented by Chai, Sun-Ki; Chin, David; Chu, Kar-Hai; Herres, Aaron
IEEE Social Computing Conference; Vancouver, BC, Canada; August 2009

Web Analyst: Software for Solving Real-World Problems by Understanding Virtual Communities
Presented by Chai, Sun-Ki
Army Research Office Workshop on Trustworthy Social Computing; Davis, CA; July 2009

Web Analyst: Software for Solving Real-World Problems by Understanding Virtual Communities
Presented by Chai, Sun-Ki; Herres, Aaron; Kang, Dong-Wan
University of Hawaii Technology Showcase; Honolulu, HI; March 2009

APPENDICES

A – Grid-Group Variables in the Modeling the Cultural Change and Political Violence
B – Cultural Values and Behavior in Dictator, Ultimatum, Trust games: Experimental Study
C – Cultural Values and Behavior in a Two-Person Game (Presentation)
D – Cultural Values and Behavior in Dictator, Ultimatum, Trust games (Presentation)
E – Cultural Dimensions and Grid-Group Theory: From Classification to Process
F – Grid/Group Cultural Theory and Behavior in Voluntary Contributions Public Goods and Bargaining Experiments
G – Grid/Group Cultural Theory and Behavior in Voluntary Contributions Public Goods and Bargaining Experiments (Presentation)
H – Endogenous Preference Change and Group Behavior in Experiments
I – Manual for CCPV Cross-country Ethnicity Dataset
J – Playing Both Roles: Role Reversal Effects and Culture in Simple Games
K – Playing Both Roles: Role Reversal Effects and Culture in Simple Games (Presentation)
L – Does Religion and Ethnic Identity influence Social Preferences? Evidence from Field Experiments in the Philippines
M – Philippines Field Experiment (Presentation)
N – Tournament Games with Externalities
O – Computing Coalitions
P – Models of Ethnic Conflict
Q – Criminal conflict as collective punishment
R – A Multi Player Conflict and Distribution Model"
S – Coherence Model Applied to Aftermath of Coalition Interaction
T – CLASSIC User Manual
U – Development of the Forum Analyzer and Twitter Analyzer

Grid-Group Variables in the Modeling the Cultural Change and Political Violence
A Preliminary Report for the First Attempt

1. Introduction-Construction of the Cultural Model

In the project, culture is classified along two abstract dimensions, based upon the best known cultural representation framework in cultural anthropology. The first is *group*, which represents the extent to which a culture emphasizes positive or negative altruism towards other individuals, as opposed to pursuit of self-interest. The second is *grid*, which represents the extent to which a culture embodies a reliance on standardized role-based rules for achieving goals, as opposed to general approaches to problem-solving. This "grid-group" framework is chosen because of its parsimony, the fact that it is probably the best-known formalized classification of cultures within the contemporary social science literature, and because its two abstract dimensions have been shown to be accurate predictors of numerous concrete cultural predispositions. While its two dimensions are deceptively simple, they also provide a systematic framework for organizing large numbers of more specific cultural attributes.

The grid-group framework has gained popularity as a conceptualization of culture in a number of branches of social science, including anthropology, sociology, and political science. Grid-group surmounts many of the limitations associated with previous theories of cultural dimensions. This framework proposes that an individual's behavior, perception, attitudes, beliefs, and values are shaped, regulated, and controlled by constraints that can be classified within two broader domains labeled as group commitment and grid control. Beliefs about humans and their world locate persons with respect to the grid and group dimensions and spawn preferences for specific patterns of

social relations. It has been argued that this theory illuminates tighter, more specific relations between disparate constrained sets of practical objectives and interests than other theories of culture. This characteristic enables theorists to capture key features of persons' political worlds more effectively. Thus, grid-group theory helps generate clearer, more easily measurable concepts than alternative frameworks for representing culture. The theory allows for the representation of distinctive, constrained, and predictable objectives and interests of each culture.

For the first step of modeling the cultural change and political violence, we will use various datasets to check the relative grid-group situations for different countries. We generate the grid and group indices for each country and use the ordinal indices to check the relative grid and group status. The results from various datasets can then be used to check the accuracy of the real culture difference.

2. The Grid-Group Theory

Culture theory was first identified by Mary Douglas (Douglas, 1970; 1982; 1992). Originally culture theory was based on two primary hypotheses. The first is that the all societies contain social pressure to conform to either the interest of the individual or the interest of the group. The second hypothesis is that there exists within each culture a set of social pressures which push a person towards insulation within society by socially and psychologically buffering and filtering outside interaction, or conversely, pushes them towards complete individual autonomy.

According to the two hypotheses, the cultures are categorized into two dimensions, group and grid (as shown in figure 1). Both dimensions of group and grid describe the degree to which the individual is controlled or limited by the social environment of which

he or she is a part. The group is defined in terms of the claims it makes over its members, the strength of the boundaries that are drawn around the group, or the degree to which the group takes precedence over the individual. The higher the degree of the group, the more the individual is constrained by rules requiring him or her to conform to group behaviors, purposes, and norms, and the more mutual cooperation and team-working is critical in operations.

The grid dimension gets its name from a "grid of rules and roles" that defines a person's place and behavior in the culture. It is the degree to which social rules either explicitly or implicitly, insulate people from others or surround them with social boundaries. The higher on the continuum of grid one goes, the greater the degree of differentiation in status, authority and ascribed roles that differentiate people and limit their interactions (Douglas, 1982). The cultural rules set the pattern of who does what, who has what access to resources and who has what privilege.

Figure 1.Grid-Group Matrix

Hierarchism (high grid; high group)	Egalitarian (low grid; high group)
Authoritarian (high grid; low group)	Individualist (low grid; low group)

Cultural theory is based on the cohort level. One culture is distinguished from others based on common characteristics and reflected by different decisions made under the same circumstance. Therefore it will be reasonable to generate an aggregate of cohort preferences based on preferences by individual level and it is necessary to investigate the individual preference to get the common beliefs within the cohort and predict its decision under a particular circumstance (Chai, 1999:116). Empirically, by using the the 210 value questions from the 1994 world value survey (WVS) data and then the following 2000

WVS data, we compare the people's difference between and within each variable though one-way ANOVA analyses. We found that the differences between countries (as proxy of the culture cohorts) are very significant while the differences within each country are not significant.

Therefore, in the following sections we will investigate the individual grid group characteristics and based on the individual level, we investigate the collective or cohort level by using country as a main cohort proxy as well as a case study for the different cultural groups within one single country (for example the United States).

3. The grid and group indices based on WVS and the data description

There are many large datasets that can be used to investigate the cultural and value differences. The most important survey data is the world value survey. The World Values Survey first emerged out of the European Values Study (EVS) in 1981, when the methods of a successful European study were extended to 14 countries outside Europe. The 1981 study nevertheless covered only 22 countries worldwide. The survey was repeated after an interval of about 10 years in the second of what came to be termed "waves". One of the aims of the project came to be the longitudinal (as well as cross-cultural) measurement of variation of values. Further waves followed the second wave at intervals of approximately 5 years. WVS also grew out of its Euro-centric origins to embrace 42 countries in the 2nd wave, 54 in the 3rd wave and 62 in the 4th wave (Wikipedia).

The WVS data are obtained through detailed questionnaires in face-to-face interviews. The questionnaires from the most recent waves consisted of about 250 questions. In each country the questionnaires are administered to about 1000 to 3500

interviewees, with an average in the 4th wave of about 1330 interviews per country and a worldwide total of about 92000 interviews.

The questionnaires of the WVS are not designed for the grid and group purpose and include only static questions. They also don't include any scenarios questions for cultural change and decision-making purposes. Hence the first step for us is to choose the questions that fit the grid and group dimensions and then validate the WVS through various methods.

To validate WVS, the first step is to conduct another survey with the scenarios questions for the cultural change and the decision-making purposes. We designed a new questionnaire based on the WVS and included the scenarios questions for cultural change and decision-making purposes. The 24 value questions are selected from the third wave of WVS questionnaires. Among the 24 value questions, there are four social values questions: family importance; friend's importance; religion's importance; and respect for parents. We also include five questions related to people's opinions on employment: whether men have more right to jobs; forced retirement; efficient workers should be paid more; business management; and following instructions. Four questions focus on national goals including less emphasis on money, decrease work importance, technological development and respecting authority. Other questions are related with social distance (people trusted), marriage and family (do women need children), social issues (ownership of business, responsibility and hard work), religion (raised religious, importance of god) and social norms (justification of homosexuality, prostitution, abortion and divorce).

Table 1 categorizes the questions within the grid-group dimension. Among them, 12 questions are assumed to reflect people's grid characteristics and 12 questions are assumed to reflect people's group characteristics. The grid questions include: religion's importance; whether men have more right to jobs; forced retirement; following instructions; do women need children; respecting authority; being raised religious, importance of god; justification of homosexuality, prostitution, abortion and divorce. The group questions include family importance; friend's importance; respecting parents; trust of people; efficient workers should be paid more; business managed; less emphasis on money; decrease work importance; technological development; ownership of business; responsibility; hard work.

(1)	(2)	(4)	(5)
	Gird	**High**	**Low**
Grid1	Religion	Important	Not important
Grid2	Job men/women	Men more rights	Not agree
Grid3	Job old/young	Young more rights	Not agree
Grid4	Follow instruction	Yes	Not necessary
Grid5	Having children	Yes	Not necessary
Grid6	Respect authority	Yes	No
Grid7	Religion (grow up)	Yes	No
Grid8	Religion	God important	Not important
Grid9	Homosexuality	Never justifiable	Justifiable
Grid10	Prostitution	Never justifiable	Justifiable
Grid11	Abortion	Never justifiable	Justifiable
Grid12	Divorce	Never justifiable	Justifiable
	Group	**High**	**Low**
Group1	Family	Important	Not important
Group2	Friends	Important	Not important
Group3	Parents	Must love & respect	Not have to
Group4	Trust people	Most can be trust	Have to be careful
Group5	Fair pay	Not fair	Fair
Group6	Business	Employee do more	Owner do more
Group7	Importance of money	Less emphasis	More emphasis
Group8	Importance of work	Less emphasis	More emphasis
Group9	Importance of tech	Less emphasis	More emphasis
Group10	Business private/government	Government	Private
Group11	Responsibility personal/government	Government	Personal

Table 1. Grid-Group Categories in our Survey

	Success hard work/luck and connections	Luck and connection	Hard work
Group12			

Our survey also includes the decision-making scenarios questions, which are designed as follows:

You and another person are participating in a business arrangement which you believe will result in a major profit for you. However, a last-minute change of circumstance that your expected profit no longer exists and will fact be a loss. You currently have no legally binding contract but you have made an informal agreement to go through the deal. You will not be punished by the government if you do not follow through with the terms of the agreement. However your business partner will suffer a large loss of money will if you do not fulfill your side of the agreement.

The questions related with the scenarios asked how likely the respondents were to proceed with the deal under different assumptions: the amount of loss is small, the partner comes from same country and the partners have a long-term business relationship with the respondents.

The survey was conducted in March 2005 in Honolulu, Hawaii. The sample was obtained from international students from different colleges and universities such as University of Hawaii at Manoa, Hawaii Pacific University, Kapiolani Community College and The East-West Center. A mixed methodology of web-based survey administration was used to obtain the samples. Since the survey mainly focuses on the

students within the above colleges, the shortcomings that are commonly found in online survey are not a problem in our survey1.

We successfully collected 166 responses after deleting three invalid observations. Among them 28 people are citizens of China, 24 are citizens of the United States and the total number of citizens for Japan, Germany and Vietnam are 19, 18 and 10 respectively. 8 people are confirmed to be Korean citizens and 7 are Indonesia citizens. Another 42 people are citizens of 31 other countries. Only the above 7 larger sample cohorts were chosen as the base for comparison because the population from other countries in our survey is very small and cannot be compared Moreover, since the WVS didn't cover Indonesia and Vietnam, we exclude them from our comparison analysis.

Assuming that both the WVS and our survey follow a normal distribution, a comparison of these two surveys using the statistical methods described above was employed. For each country, we compared WVS sample and our sample. For the United States cohort, our survey and the WVS have the same standard deviations for 17 questions and the same mean values for 9 questions (significant at a 0.05 level, if based on a 0.1 level, then the number increased to 11). The results are comparable considering no controls for any effects for the two surveys were utilized.

After controlling for the effects of education and age (most of the international students in our survey were very young and had higher education levels than the population in the WVS) the number of questions that the two samples had the same standard deviations increased to 19 questions. Those with the same mean values

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[1] Several shortcomings are commonly found in online surveys: (1) their sampling frames include only computer users; and (2) lack of effective control on their sampling and data-collection processes, so that they would not be manipulated.

increased to 16 questions (significant in 0.05 level, if based on 0.1 level, then the number increased to 18).

This method was used to check different countries and got similar results. Tests on China, and Germany were also good enough to validate the WVS survey. However, Japan is different because in the WVS, the number of Japanese with a higher education than college is 0 and the average education is 5.41, much lower than other countries in our survey. This also contradicts our sample in which most Japanese have higher education. The results of comparison are therefore not as ideal as for other countries. In the future analyses, we have to eliminate Japan from our sample for the same reason.

Then we checked the relationship between the value questions and the scenario questions. For each question, in order to make comparisons, we reordered every question then normalized the answer in a [0, 1] distribution so that for each grid question, a lower score means lower grid and a higher score means higher grid. Similarly, for each group question, a lower score means lower group and a higher score means higher group. Then we generate the grid and group index through equally weighted aggregation divided by the total questions that the interviewee answered. If some interviewee didn't answer some questions in the formula, then the assigned value for that component will be zero and the index will be the average of the rest of components.

According to the Cohort theory, the Grid index and Group index are both supposed to be negatively correlated with Q6 (i.e. high in either means more likely to proceed); The grid index should be positively correlated with QA (QA = Q7 - Q6), because high-grid individuals place a high priority on prior agreements, even if they are not legally binding. The Group index is positively correlated with QB (QB = Q8 - Q6),

because high-group individuals place a high value on the welfare of other group members. The relationship between grid index and QB and between the group index and QA are not significant. The group index should also have a more negative correlation with Q7 than the grid index and the grid index should have a more negative correlation with Q8 than group. Finally, if both should be negative the relationship between grid, group and Q9 or Q10 is not clear, but these are factors that may also be relevant to decision-making.

To verify the theoretical relationship, a correlation map of question 6 to question 10 was constructed as well as QA and QB for both methods. These two methods yielded similar results and the results perfectly coincide with the theory. The only aberration is the relationship between grid and QA= Q7 - Q6, which is not positively correlated due to the small sample size.

In conclusion, our survey validates our theoretical assumptions. Since our survey sample can represent the world value survey, we can use the world value survey to investigate the people's grid and group characteristics as well as grid and group characteristics in aggregated country level data.

4. Preliminary Results

The data we use includes wave 1 to wave 3 of the WVS data. As we mentioned above, wave 1 includes only 22 countries (if counting West and East Germany as two countries then 23 countries plus the city of Tambov in Russia would be 24). We generate the grid and group index for each individual and weighted aggregate of the individual index into the country average. One-way ANOVA analysis suggested that the index is significant between countries. Among the 24 countries, the average grid index score is 0.64. North Ireland (0.76) registered the highest score and Denmark (0.46) has the lowest

score. The average group index score is 0.45. Finland (0.51) has the highest group value

and Japan (0.35) and Western Germany (0.39)'s score are the lowest.

Table 2 Countries Comparison within the Grid-Group Dimension based on the wave 1 of WVS						
high grid-high group			High grid-low Group			
	grid	*group*			*grid*	*group*
"Italy"	4	0.663	0.460	"N Ireland"	10	0.760	0.444
"Belgium"	7	0.648	0.478	"USA"	11	0.713	0.402
"Spain"	8	0.688	0.490	"Canada"	12	0.671	0.430
"Ireland"	9	0.693	0.456	"Mexico"	14	0.759	0.395
"Australia"	17	0.658	0.484	"S Africa"	15	0.712	0.414
"Tambov"	20	0.757	0.461	"Hungary"	16	0.705	0.442
"Iceland"	21	0.640	0.454			
"Argentina"	22	0.667	0.476			
Low grid-High Group			Low grid-Low group			
	grid	*group*			*grid*	*group*
"France"	1	0.622	0.507	"Britain"	2	0.629	0.416
"Netherlands"	5	0.495	0.470	"W Germany"	3	0.598	0.390
"Denmark"	6	0.459	0.492	"Japan"	13	0.574	0.348
"Norway"	18	0.590	0.454	"S Korea"	24	0.630	0.435
"Sweden"	19	0.476	0.458			
"Finland"	23	0.540	0.508			

Among these 24 cohorts, if we use the average country-level index value as the

curve, we can get the following results (Table 2). Firstly, since most countries are

European countries in the wave 1 of WVS it is not surprising that the differences between

countries are not huge since they are culturally and geographically similar. For example,

Norway, Sweden and Finland are geographically located in Northern Europe and all of

them are categorized into the low grid and high group area in our simple dimension map.

USA, Canada and Mexico, as North American countries, also share the same category of

high-grid and low group. Secondly, it is noted that this simple categorizing method can

only show the relative grid-group scores not the absolute value. That the USA belongs to

the high gird-low group can only be interpreted as the USA grid-group value in relation

among to these 24 cohorts. When more countries join the WVS, USA most likely will change its relative position.

The WVS wave 2 includes 44 cohorts. The average grid index score is 0.61. Poland (0.81) registered the highest score and Sweden (0.39) has the lowest score. The average group index score is 0.48. Switzerland (0.58) has the highest group value and Eastern Germany (0.399)'s score is the lowest.

Table 3 Countries Comparison within the Grid-Group Dimension based on the wave 2 of WVS							
high grid-high group				**High grid-low Group**			
		grid	*group*			*grid*	*group*
"Italy"	4	0.648	0.511	"USA"	11	0.619	0.460
"Spain"	8	0.619	0.565	"Mexico"	14	0.625	0.470
"Ireland"	9	0.694	0.512	"S Africa"	15	0.785	0.447
"N Ireland"	10	0.680	0.512	"Hungary"	16	0.636	0.466
"Poland"	25	0.812	0.533	"Argentina"	22	0.635	0.474
"Switzerland"	26	0.618	0.581	"Nigeria"	29	0.808	0.472
"Brazil"	28	0.700	0.502	"India"	32	0.776	0.457
"Chile"	30	0.737	0.506	"Bulgaria"	36	0.623	0.481
"Turkey"	44	0.726	0.487	"Romania"	37	0.712	0.476
				"Portugal"	41	0.664	0.480
				"Austria"	42	0.619	0.448
				"Lithuania"	46	0.703	0.437
				"Russia"	50	0.610	0.477
				"Slovakia"	85	0.644	0.484
Low grid-High Group				**Low grid-Low group**			
		grid	*group*			*grid*	*group*
"France"	1	0.575	0.486	"W Germany"	3	0.520	0.458
"Britain"	2	0.558	0.508	"Canada"	12	0.561	0.477
"Netherlands"	5	0.443	0.526	"Iceland"	21	0.520	0.475
"Denmark"	6	0.470	0.502	"Finland"	23	0.438	0.468
"Belgium"	7	0.585	0.520	"S Korea"	24	0.596	0.475
"Japan"	13	0.491	0.497	"Czech"	33	0.541	0.442
"Norway"	18	0.491	0.520	"E Germany"	34	0.560	0.399
"Sweden"	19	0.395	0.526	"Slovenia"	35	0.568	0.442
"Belarus"	31	0.594	0.513	"Latvia"	47	0.590	0.448
"China"	39	0.460	0.497	"Estonia"	48	0.584	0.418
"Moscow"	45	0.547	0.506				

Wave 2 of WVS was taken in 1990. Therefore the new cohorts added in the survey include several new independent countries and the newly independent countries show very strong similarities. Former Soviet Union member states and Eastern European nations that were strongly affected by communism, after the revolution of late 1980s, show very strong low group values. For example, Latvia and Estonia are neighboring countries, and both belong to the low grid and low group category. It is reasonable since the it is necessary to define the definition of "group" for those countries recently escaping the control of the former Soviet Union. Other countries such as Western Europe and North American didn't change a lot from wave 1 of the WVS.

The WVS wave 3 included 55 countries. The average grid index score is 0.63. Nigeria (0.84) registered the highest score and Sweden (0.34) has the lowest score. The average group index score is 0.51. Basque (0.56) has the highest group value and Bangladesh (0.39)'s score is the lowest.

In the third wave, the new countries joining the survey are mainly developing countries. Therefore, the new results shown in table 4 are different with that of wave 1 and wave 2. At first glance, most developed countries have lower grid values than developing countries. The linage analysis between the grid value and the economic development is therefore very necessary. As always, the geographical relationship is very strong, particularly for the newly formed nations and strong ethnic groups such as Armenia, Georgia, Bosnia, and Azerbaijan Herceg. People from these countries have very strong ethnic-identifications and therefore have very high grid scores as well as high group scores. China differs from wave 2, in which it belonged to low grid-high group category, now belongs to the high grid and high group section. We attribute this

difference to the political violence in 1989-1990. It strengthens our assumption that the

political violence has strong effects on people's value opinions.

Table 4							
Countries Comparison within the Grid-Group Dimension based on the wave 2 of WVS							
High grid-high group				**High grid-low Group**			
		grid	*group*			*grid*	*group*
"Tambov"	20	0.642	0.519	"Mexico"	14	0.703	0.478
"Poland"	25	0.750	0.554	"S Africa"	15	0.732	0.461
"Brazil"	28	0.763	0.511	"Puerto Rico"	27	0.727	0.452
"Nigeria"	29	0.844	0.508	"Lithuania"	46	0.657	0.467
"Chile"	30	0.703	0.530	"Peru"	51	0.667	0.452
"India"	32	0.762	0.508	"Venezuela"	53	0.748	0.492
"Pakistan"	38	0.815	0.553	"Ghana"	56	0.816	0.504
"China"	39	0.670	0.509	"Philippines"	58	0.775	0.460
"Taiwan"	40	0.655	0.524	"Moldova"	61	0.708	0.486
"Turkey"	44	0.663	0.511	"Dominic Rep"	68	0.663	0.485
"Georgia"	62	0.687	0.530	"Bangladesh"	69	0.788	0.387
"Armenia"	63	0.643	0.525				
"Azerbaijan"	64	0.701	0.516				
"Colombia"	73	0.781	0.544				
"Andalusia"	78	0.641	0.553				
"Macedonia"	83	0.689	0.520				
"Bosnia Herceg" /	93	0.663	0.513				
Low grid-High Group				**Low grid-Low group**			
		grid	*group*			*grid*	*group*
"Spain"	8	0.604	0.551	"Britain"	2	0.488	0.426
"Norway"	18	0.457	0.545	"W Germany"	3	0.421	0.483
"Sweden"	19	0.340	0.550	"USA"	11	0.616	0.475
"Argentina"	22	0.618	0.512	"Japan"	13	0.456	0.487
"Finland"	23	0.484	0.517	"Australia"	17	0.521	0.500
"S Korea"	24	0.622	0.562	"Switzerland"	26	0.483	0.495
"Bulgaria"	36	0.579	0.514	"Belarus"	31	0.627	0.496
"Ukraine"	49	0.624	0.537	"E Germany"	34	0.439	0.498
"Russia"	50	0.606	0.513	"Slovenia"	35	0.572	0.476
"Uruguay"	54	0.626	0.527	"Latvia"	47	0.526	0.464
"Basque"	75	0.508	0.563	"Estonia"	48	0.549	0.464
"Galicia"	79	0.511	0.530	"Croatia"	84	0.618	0.475
"Valencia"	80	0.551	0.536				
"Serbia"	81	0.623	0.510				
"Montenegro"	82	0.626	0.543				

Actually, most of countries follow our basic cultural and value assumptions. For the results here, I believe that the WVS coincides with these assumptions very well. It is therefore a good method to use the WVS itself to validate the WVS for the grid group analysis.

I will keep working on the analyzing the data. The following steps are considered.

- For those countries that join all three waves, I will investigate the changes of their values.

- For the wave 4 of world value survey, I will check the grid group values without that two questions

- Start to check ISSP questions and compare the result with WVS.

Topic: Cultural values and behavior in dictator, ultimatum, trust games: experimental study

Sun-Ki Chai, Dolgosuren Dorj, Min Sun Kim, Ming Liu, and Katerina Sherstyuk[1]

Abstract

We build cultural profile of subjects using attitudinal questionnaires drawn from the World Value Survey to predict variations in behavior in dictator, ultimatum and trust experiments. 220 subjects were provided with pretest surveys, which were used to generate measures for each subject along grid and group, two very prominent and general cultural dimensions drawn from social/cultural anthropology. Grid was hypothesized to induce enforcement of social norms of reciprocity, and group to induce altruism towards other individuals. These subjects were then placed in ten decision rounds of various games in a stranger setting. Overall, we find that the group (altruism) attribute was positively and significantly correlated with the level of offers in the ultimatum game. The lowest acceptable amount was greater for subjects with higher grid (reciprocity) attribute. The high grid (reciprocal) subjects were also more willing to punish (designate less dollars) in the convex version of ultimatum game. Besides grid/group measures, we employ an alternative cultural instrument, the individualism/collectivism score. We find that the individualism score was negatively correlated with donations, while the collectivism score predicted trusting actions. Our contribution is twofold. First, we provide a methodology that uses general cultural dimensions to predict differences in behavior under widely varying conditions. Second, we find that the distribution of cultural types in our subject pool reflects existing distribution of human types in social preference studies.

JEL classification codes: C7, C91, Z1.
Keywords: Cooperation, Two Player, Experiment, Culture, Survey.

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CCPV Round 1 grid/group paper (May-July 2009 experiments)

1 Introduction

Previous research finds controversial results in the use of attitudinal questions to predict behavior in the lab. General survey responses were not valid to measure trusting behavior (Glaeser et al. 2000, Ahn et al. 2003). Others find attitudinal questions to be a good predictor of trusting or cooperative actions (Capra et al. 2007, Chuah et al. 2009). In this paper, we measure social preferences using attitudinal survey and use this tool to predict behavior in two-person games. In our experiments culture is conceptualized based upon the grid-group framework for representing general dimensions of cultural values, which introduced by anthropologist Mary Douglas (1970), later by her work with Wildavsky (1982). In our previous study (Chai et al. 2008) conducted in the lab we have shown that group attribute was highly correlated with the contributions and grid attribute was significantly correlated with the punishing behavior in public good games with and without punishment opportunity. Here ``group'' refers to the degree of solidarity (altruism) among members of a particular group (society, community). At the same time ``grid'' refers to the degree to which individual's behavior constrained by the norm and rules (strong reciprocity) of the group. We hypothesize that individuals from western cultures that are more individualistic (with low-gropness and low-grindness characteristics) will act in a more self-interested manner and would not penalize others at his/her own cost while a person from collectivist culture (with high-groupness and high-gridness characteristics) will act more altruistically toward others and will incur costs to punish others.

Our paper differs from previous research in a way that we provide a measure of individual's preferences through the survey. Grid/group measure (ala Mary Douglas 1982) will allow us not only explain individual's behavior in the lab, but more importantly we draw a comparison between grid/group measure and collectivist versus individualist measures to predict the outcome. Note that in the grid/group framework individualistic culture is represented by low-grid and low-group characteristics.

Previous attempts to incorporate a survey instrument linked trusting attitudes with actual contributions in experiments (Glaeser et al. 2000, Ahn et al. 2003, Ashraf et al. 2003, Danielson and Holm 2003, Gächter et al. 2004). Out of several measures of trust attitudes, it has been found that `` General Social Survey *(GSS) trust* question least accurately reflects actual trusting and cooperative behavior. The *Trust strangers* and the *GSS fair* and *GSS help* questions seem to reliably reflect trusting and cooperative behavior'' (Gächter et al. 2004). Glaezer et. al (2000) also find that past behavior is a good predictor of trusting behavior in the lab; survey measures better predict trustworthy behavior than trusting behavior. Fehr et. al (2002) combine nation-wide survey and sequential trust game experiment in Germany using GSS questions, Glaezer et. al. (2000) survey and other surveys. They "identified two instruments outside the lab to be a good predictor of trusting behavior in experiment: direct questions about trust in strangers and questions about past trusting behavior". In line with Glaezer et. al. (2000) the survey measures of trust were

good predictors of trustworthiness in the experiment. Capra et al. (2007) used World Values Survey (WVS) and GSS questions to explain trust in a series of games: investment game (Berg et al 1995) with triadic structure (Cox 2004), binary trust game, dictator game and the public good game. Capra et al. (2000) find that attitudinal questions may predict trusting actions depending whether the altruism is controlled for. Chuah et al. (2009) relate WVS attitudinal questions responses across UK and Malaysian subjects in the ultimatum game and suggest that higher offers of Malaysian subjects may reflect their attitudes towards individual freedom and civic-mindedness. Higher offers in both subject groups were due to whether a person has materialist and work-leisure values and be non-religious. All above studies consider the relationship between particular attitude and experimental behavior. None of these studies attempt to connect social preferences through the survey with the behavior. Ma et al. (2002) used selected questions from Personal Meaningful Profile questionnaire to measure altruism and match subjects according to altruistic scores in the public good games. Differing from our survey measures reciprocal preferences in addition to altruistic preferences. Moreover, we use WVS questions to construct a measure of social preferences and connect this measure with the laboratory actions. Our contribution is to provide a methodology to measure social preferences built from WVS questions and show to what extend these measures correlated with economic behavior in the laboratory experiments. In addition, we use this tool to explain how behavior differs across individuals came from individualistic/collectivist cultures.

First, we administered online survey that included individualism and collectivism questions (Leung and Kim, 1997). Moreover, attempt is made to use Inglehart index of materialism and post-materialism to predict behavior in lab. Demographic and identity questions were asked at the end of the online survey. In order to capture grid/group characteristics 22 selected questions from the WVS (Inglehart et al. 1998, 2004) have been conducted prior to the treatments in the lab. See Appendixes for the survey questions. We calculate grid [2] and group[3] indexes in line with the formula in the footnote. For reasons of robustness, two alternate grid/group questions were conducted through the online survey each of them being items to capture either grid or group.

Experimental design

The objective of this paper is to test the effect of grid/group (culture) on pro-social behavior. To fulfill this purpose, we invited 220 students to the online survey prior to their lab session. All subjects were recruited from UHM campus during May-July 2009

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[2] grid=((4-Answer[3])/3+(3-Answer[6])/2+(3-Answer[7])/2+(3-Answer[10])/2+(2-Answer[11])/1+(3-Answer[15])/2+(Answer[18]-1)/9+(10-Answer[19])/9+(10-Answer[20])/9+(10-Answer[21])/9+(10-Answer[22])/9)/11;

[3] group=((4-Answer[1])/3+(4-Answer[2])/3+(2-Answer[4])/1+(2-Answer[5])/1+(Answer[8]-1)/1+(Answer[9]-1)/3+(3-Answer[12])/2+(3-Answer[13])/2+(Answer[14]-1)/2+(Answer[16]-1)/9+(10-Answer[17])/9)/11;

for total fifteen sessions (Table 1). Each lab session consisted from two main parts. First when subjects arrive in computer[4] terminals at HCXC lab, they prompted to answer 22 WVS selected items that took 15-20 minutes to accomplish. Immediately, after the survey subjects were randomly matched with one another so that all matches were unique (absolute stranger matching) in the session. Subjects were placed in the dictator game, non-convex ultimatum game, convex ultimatum game, non-convex faith game and convex trust game. Sessions vary depending on one-role and two-role treatments. In one-role treatment each subject was placed either in the proposer role or responder role while two-role treatment placed everyone in both roles. In the one-role treatment computer randomly determines the role for the player at the beginning of the session. If subjects had chosen to be a Proposer then he/she makes only the proposer's decision in all consecutive games. If a subject happen to be a responder then he/she makes only a responder's decision in all games. In the two-role treatment everyone was making first a proposer decision, then everyone was making a responder decision matched with a completely different person than in the first task. Therefore, in the one-role treatment subjects made five decisions and paid for two randomly chosen tasks while in the two-role treatment subjects made nine decisions in ten pairs and were paid for one randomly chosen game in which participant made two decisions. We employed the strategy method in each game so that both the proposer and responder make choices without knowledge of the opponent's actual decision. In each decision period subjects were matched with different participants from their session. The sessions lasted one hour and on average subjects were paid 19 dollars. In all sessions, we did not provide any feedback on the results after each task and there was no way to identify the matched person in each task. No feedback design prevents ordering effect and learning effect. To avoid income effect, we use random payment. Subjects knew that at the end of the session one part (two-decisions out of nine) of the session for the two-role treatment or two decisions out of five decisions for the one-role treatment was randomly chosen for the payment. At the end of the session computer displayed earnings for each part of the session and randomly chosen payment. Next we explain each game in details and provide the hypothesis to be test.

Dictator game

Dictator game is a two-person game as much like as ultimatum game (Guth et al. 1982) but without the second stage. The proposer's decision is not affected by the belief about the responder's action. Forsythe et al. (1994) finds that dictator offer is much lower than the ultimatum game offers and hence conclude that offers in the latter game are due to not only fairness effect but also strategic concerns. In our dictator game, a sender was endowed with 10 dollars and has given an opportunity to split the money between herself and the counterpart. In our two-role treatments, everyone was made the decision as a sender and in the one-role treatments only proposers made decisions. In the latter case while proposers were making decision, receivers were waiting.

Hypothesis for the dictator game: (i) High-group individuals will give more to the paired person than the low-group individuals. (ii) Amount of giving is higher for the low-group

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[4] We used z-tree software for both the attitudinal survey and experiments (Fischbacher 2007).

individuals in the dictator game than in the ultimatum game. (iii) Amount of giving for high-group individuals will be no different across dictator and ultimatum games.

Ultimatum game

The ultimatum game is a two-person game, in which a proposer (role A) decides on the division of 10 dollars between himself/herself and a responder. In the sequential version of the ultimatum game (Guth et al. 1982) responder moves knowing the offer made by proposer while in the simultaneous version of the game known as a strategy method responder provides only minimum offer level he/she may accept. In the convex version of the strategy method (Andreoni 2003) responder provides the amount of dollar to be divided. We use two versions of the ultimatum game: strategy version of the ultimatum game was introduced first, then subjects experienced convex version of the ultimatum game. In the two-role treatment, each subject was placed in the role of the proposer who decides on the division of 10 dollars between him/her and the paired person. Then each of them had an opportunity to be a recipient whose task was to submit the minimum offer he/she is willing to accept from the different person than the first match. In the one-role treatment subjects were placed either in the role of a proposer or in the role of a responder. In the convex version of the game, the proposer's task was to choose the dividing rule and the responder's task was to specify how many dollars from ten dollars total he/she wants to divide for each possible dividing rule. Decisions were matched by the computer and no feedback was given.

Hypothesis for the ultimatum game: 1) group score is positively correlated with the proposer's offers; 2) grid score is positively correlated with the rejection rate for a given level of offers. 2a) high-grid individual's rejection rate highly varies with the level of offers;
2b) low-grid individuals reject less for given level of offers;

Trust game

Trust plays important facilitating role in exchange economies that promote growth and development. We use "trust" game to study how grid/group cultural attribute affects trusting behavior among individuals originating from different cultures. In the convex version of the trust game two players have a role of truster (role A) or trustee (role B). Truster moves first and decides whether to trust by sending to the trustee some or all money which will be tripled by experimenter (Berg et al. 1995). Allowing the variable action for the truster allows us to precisely measure the degree of trust, which is given to the trustee. Trusted trustee had the opportunity to send back a certain amount of money back to truster. Our convex trust experiments differ from Berg et al. (1995) trust experiments by the fact that procedures are mediated by the computer, earning records are known to the experimenter (not double blind) and the second mover does not know the first mover's action. In addition in our setting money doubles instead of tripling. Subjects had an opportunity to send back all or any portion of the doubled money, i.e. 0,

1, 2, …, 12. We call such game as a faith game. The subgame perfect Nash equilibrium of the faith game is to send nothing while social optimum requires sending all endowments. In this setting trust is the reliance on the B players characteristics and expectations put forward on the trustee. In the non-convex version of the trust game player A's choice is binary (trust all money or no trust) and player B makes a decision without knowing the counterpart's decision. After the dictator game, standard and convex ultimatum games subjects experienced first the non-convex trust game followed by the convex trust game. In both versions of the game, we employed the strategy method. In each version of the trust game truster was given six dollars while the trustee had no endowment.

Hypothesis for the trust game: (i) Individuals with high group scores will trust more in the trust game with a binary choice (send more in the investment game Berg et al 1995) when they are placed in the truster role.
(ii) High-grid individuals return more than low-grid individuals provisional on the level of trust offered.
(iii) Individuals from individualistic cultures tend to have more general level of trust (Yamagishi 1998 et al.).

Results

Most economic decisions involve repeated interaction with mutual responses, where sometimes a person undertakes one role and in other times a person plays the second role. Our two-role treatment allows subjects to experience both roles of two-person games, i.e. be a dictator and recipient, proposer and responder, truster taking a risk and trustee honoring trust. However, our design reflects one-short situation, therefore subjects were matched with a completely different person each time they make a choice. Therefore, each decision will be treated as independent observation because we employed strategy method to extract data and there was no feedback following the decisions. We start the report with the dictator game.

a. *Overall results*

Results of the two-role treatment

Dictator game:

Previous experiments show that donations in dictator game vary dramatically from zero in double blind designs (Hoffman et al. 1994) to half of the endowment in designs where the recipient gives a brief description about herself or himself to the proposer (Bohnet and Frey 1999). In our experiments, we did not employ the double blind design; indeed subjects provided personal characteristics and their attitudes on particular matters. In line with predictions, donations in our sessions were above zero, but below fifty percent of the endowment.

Result 1: Mean donations were less than half of the total pie to divide. Modal offers were fifty percent of endowment. Cultural variables were silent in the dictator game.

Support: In the divide $10 dictator game the mean for all sessions was 3.32, which is below the fifty percent of endowment (Table 2). Overall 28 percent of population offered half of their endowment, 43 percent of subjects offered from $2-4 and 14 percent of population provided the paired person with zero money (Figure 2). However, we find 2 observations at each $9 and $10 offer. Offers of nine or ten dollars are most likely to appear due to confusion or due to the fact that we obtained information on personal characteristics including subject's name. As predicted in terms of cultural variable, group scores that are accountable for the altruism were positively correlated with the donations, but were insignificant. Since in the dictator game there is no strategic concern to offer and fear of rejection removed, altruism, moral norms or social norms explain giving.

Non-convex ultimatum game:

Hoffman et al. (1994) find a decrease in offers when the right to be a first mover was granted based on the general knowledge test score in the ultimatum game. Offers were higher with the random entitlement to be a proposer. In our two-role experiments, all subjects experienced a proposer role and all subjects experienced a receiver role but were paired with a completely different person than their first match. Cultural variables were most pronounced in the ultimatum game.

Result 2: Offers in the non-convex ultimatum game were higher for high-groupness individuals and were lower for the high-gridness individuals. High-groupness individuals accepted lower offer while the threshold of the acceptable amount was higher for the high-gridness individuals.

Support: Consistent with previous finding percent of population offering half of their endowment rose to 37, percent of subjects offering from $2-4 fell to 39 and only 2 percent of population provided zero money to their match (Fig. 4) as compared with the 14 percent in the dictator game. Pearson correlations of offers were significant for the group score and grid score (Table 3). We model offers in the ultimatum game as a function of group and grid scores, controlling for personal characteristics that may influence the level of altruism such as gender, education, age, citizenship. Since offers may be censored from the left by zero, we estimate Tobit model. The results of regression are displayed in Table 4. The variable gender=0(1) for fe(males). Education is equal to 1, 2, …, 7 for freshman, sophomore, junior, senior, M.A., PhD, faculty/staff correspondingly. Age specifies the age of a participant. Citizenship is a dummy=1 if a person is a US citizen, and equal to zero otherwise. The results of regression in Table 4 show that the group score (altruism) significantly and positively affects offers (p=0.018) and grid score (reciprocity) significantly negatively affects offers (p=0.013). The main hypothesis, the positive impact of group score on offers was verified in the ultimatum game. Moreover, those with a higher group score have a lower acceptable amount (variable minimum) than those with lower group scores (p=0.019). At the same time

those with the higher grid score accept higher amounts in the single variable regression (p=0.043), but with demographic variables significance drops (p=0.104).

Convex ultimatum game:

 Next we explore offers in the convex ultimatum game ala due to Andreoni et al. (2003) where proposers offer percentage of the total pie to the designators who in turn decide on the amount of dollars to be divided for each possible dividing rule. Our experiments were implemented in a computer lab and the total money to designate was $10. The regression results with the same specifications show a positive but not significant effect of group score and negative significant effect of grid score on the proposer's decision.

Result 3: High-gridness individuals divide fewer dollars as designators than low-gridness individuals. High-groupness individuals (LH) and individualistic types (LL) designate more dollars (divide more dollars to be divided between two) than other types.

Support: The average offer was 35.7 percent of the total pie. The modal choice was the equal split offer at 37 percent. 45 percent of total offers were between 10-40 percentages of the pie. Only 9 percent of offers were at the subgame perfect equilibrium (99, 1). The total rejection rate was 7 percent (variable designate). 41 percent of subgame perfect offers were rejected (variables if99, if1).
In line with predictions regression results show that grid score had a significant negative effect on the amount to be divided (p=0.006). This indicates that high-gridness subjects were willing to bear a cost of punishing others by dividing fewer dollars. (p<0.0114, Wilcoxon ranks sum test, HH+HL < LL where HH indicates high-grid and high-group, HL means high-grid and low-group, LL indicates low in both dimensions).

Again individuals with a higher group score offer more percentages to the paired person. This result was not significant in the regression results (Table 4). However, Wilcoxon-Mann-Whitney test show that high-groupness individuals (LH) and individualistic types (LL) designate more dollars when the dividing rule is above fifty percent of endowment (p<0.05 in Table 5). Attempt to divide more dollars by two types has different underlying reasons. High-groupness (altruistic) individuals benefit when the total shared amount is large for both the proposer and designator, while individualists divide more dollars in order to benefit more for them. This is specially can be seen when the other side offers 50% or more percentage of the pie.

Comparison across the standard and convex versions of the ultimatum game shows no difference in the offers. Exactly, 37 percent of offers were equal split in both games (Fig. 10). Percent of trusted high-groupness individuals were higher than the percent of trusted low-groupness individuals in both versions of ultimatum game (Wilcoxon-Mann-Whitney test, p=0.0375, p=0.0664 respectively).
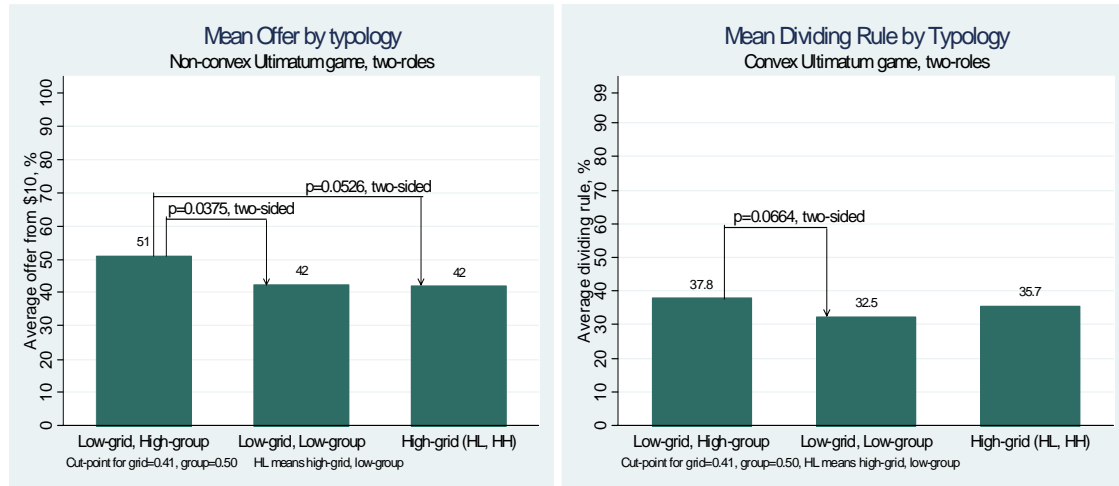
Non-convex trust game:

In the faith (non-convex version of trust) game overall 59 percent of subjects trusted others and sent money ($6) which will be doubled by experimenter. In the faith game recipient may return all or some portion of money back to the truster. With this setting, 17 percent of subjects acted in a self-interested manner by returning zero sums to the trusted person. The modal return was $6 involving responses from 45 percent of the subject pool. 78.8% of responders returned some portion of the trusted money.

Result 4: High-groupness individuals on margin trust more and sent money to the trustee in the faith game. Age (altruistic reason) and US citizenship (future own benefit reason) have also positive effect on trusting action.

Regression results in Table 4 show that on margin group score positively affects trusting actions in the non-convex version of the trust game (p=0.082). Interestingly, older people and US citizens trusted more (p<0.05). The latter result is similar to findings from the cross-societal questionnaire survey in Yamagishi and Yamagishi (1994) and cross-societal experiments in Yamagishi et al. (1998) study where US citizens have higher level of general trust than Japanese.

Convex trust game:

In the convex version of the trust game, a proposer had the option to send all or any portion of the endowment. The amount trusted was doubled and responders may send back any portion of the doubled money back to the truster.

Result 5: In the convex trust game, mean of the trusted amount was below the fifty percent of total endowment. Grid scores were negatively correlated with the amount sent back to truster. Age has positive effect on trusting behavior.

Support: Data shows that 19 percent of subjects kept all money for themselves. In the convex trust game, only 32 percent of subjects trusted all their endowments in comparison with 59 percent in the binary (trust or no trust) game. The mean amount sent were 2.85 from a total of $6. Further, 51 percent of responders kept all money and did not reciprocate trusting behavior while 11 percent sent back $6. The rest of data lies in the range between 1 and 5 dollars. The amount of reciprocal act, i.e. returning a portion of the trusted money, has dropped from 17 percent to 51 percent in the two versions of the trust game. Since there was no feedback between different games, we do not expect any sequencing effect in later games due to subject's previous game experience. This result can be attributed to the different versions of the game, i.e. in the binary trust game majority (59 percent) trust each other and more people reciprocate back trust while in the convex version of the trust game percent of reciprocation falls simply because trusters were given possibility to send any portion of money from zero to all endowment. Hence, this situation produced expectation of a fewer dollars to be sent from truster, therefore 51 percent of responders sent zero dollars to the trusters.

Pearson correlations show that high-gridness subjects returned less money than low-gridness individuals (p=0.0247 in Table 3). In the regression, age has a positive effect on trusting behavior (p=0.007). Percent of non-trusting actions were higher in the convex version of the trust game (17 vs. 51 percent of population).

Results of the one-role treatment

In some real life cases, decisions involve only one-way interaction where your role is fixed, and you never will be placed in the other role. One-role treatment reflects a unique role situation.

Result 6: *People of age and those with US citizenship happen to donate more. Furthermore, female subjects on margin donate more.*

Regression results in Table (6a, 6b) show that age and US citizen variables positively affect giving actions in the dictator game (p=0.01). Interestingly, female subjects on margin donate more (p=0.06, p=0.05 for the regressions with groupscore and gridscore respectively).

Result 7: *Age positively affected the offers. Subjects with more years of education marginally offered less. US citizens on margin offer more and accept lower offers.*

Subjects of age happen to offer more to the other side (p=0). Also education negatively affected offers while US citizenship positively affected offering decisions (p=0.07, p=0.08 respectively). At the same time US citizens accepted on margin lower offers (p=0.06, p=0.067 respectively) demonstrating that those with US citizenship were offering more in expectation of productive exchange.

Result 8: *Mean dividing rule in the convex ultimatum game was lower than fifty percent. Marginally, age and US citizenship variables were significantly positively correlated with the dividing rule (percentage of the pie given to the other side).*

Both p-values for age and US citizen variable were significant at 10 percent level (p=0.06 for age and p=0.07 for US citizen in both regressions). See Table 6b.

In the faith game 49 percent of subjects trusted others and sent money ($6) which will be doubled in the one-role treatments. 40% of people returned some money if were trusted.

Result 9: *Females trust more than others in the faith game. High-groupness individuals sent back more to trusters in return to trust.*

Individuals with higher group scores exhibited more reciprocal action, i.e. sent back more in return to trust (p=0.041). Gender affect trusting decision in a way that females trusted more (p=0.049, p=0.026 for regressions of faith on demographic variables on top of groupscore and gridscore respectively). See Table 6a, 6b.

Result 10: *In the convex trust game, mean amount trusted was below fifty percent of total endowment. On margin US citizens sent more amount than others in the sender roles, at the same time if they happen to be in the receiver roles, they return less money.*

Again very marginally US citizenship variable was positively correlated with the trusting actions (p=0.067, p=0.04) and negatively correlated with the trustworthy actions (p=0.073, p=0.075). This result suggests that US citizens trust institutions for the own benefit.

22 percent of subjects kept all money for themselves while 42 percent trusted all their endowments. 69 percent of responders kept all money and did not reciprocate trusting behavior while 8 percent sent back $6 or $7. The rest of data lies in the range between 1 and 5 dollars. Percent of non-trusting actions were higher in the convex version of the trust game (18 vs. 69 percent of population) while percent of trusting actions decreased from 45 to 8 percent. See Table 6b for the regression results.

Overall in the one-role treatment grid and group attributes were not correlated with any of the decisions except the group score was positively correlated with the binary variable trust.

b. Distribution of cultural types

The survey instrument allows us to distinguish between certain types: altruists or unconditional cooperators (LH), individualists or free riders (LL) and reciprocal or conditional cooperators (high-grid (HH+HL) that exhibit willingness to punish others at their own cost. Interestingly, the distribution of types found in our study is very close to other studies of behavioral types' distribution. For example, in other studies number of

selfish types varies around 20-33%, another 13-20 % of population comprises of altruists and half of the population (majority-50-63%) is reciprocal.

For example Kurzban, Houzer (2005) classify subjects using their linear conditional-contribution profile (LCP) in a public good environment: 20% were free riders, 13% were cooperators and 63% were the reciprocal type.

Fischbacher et. al. (2001) and Gachter et. al (2003) employ one-short unconditional and conditional contributions in public good setting as a classification device and find the following distribution: 33% were free riders, 50% were reciprocal or conditional cooperators.

The distribution of types based on our survey instrument are as follows:

In one-role treatments 24 % was LH (altruists)
                     31.7 % was LL (selfish)
                     44% was High-grid or reciprocal (HH-20, HL-24)

In two-role treatments 31 % was LH (altruist)
                     21 % was LL (selfish)
                     48% was High-grid or reciprocal (HH-23, HL-25)

Among altruists (LH-types) in the non-convex trust game, two-role treatments 66 % trusted others, among selfish (LL) only 42% trusted others while among reciprocal (high-gridness) individuals 64% trusted others. Difference between reciprocal (high-gridness) or altruists (high-groupness) people vs. individualistic/selfish (LL) types was significant at 10% level ($p=0.0918$, $p=0.0983$ respectively Table 7). In the convex trust game, reciprocal (high-gridness) people trusted more than individualistic/selfish types ($p=0.0666$). Yamagishi (2001) based on attitudinal measures (Rotter 1967, Yamagishi 1986, Yamagishi and Yamagishi 1994) finds that high-trusters are more accurate predictors of their partners' choices than the low-truster. Therefore, high-trusters happen to be more cooperative when they expect others to be cooperative.

Other studies on social preferences (Offerman et al., 1996; Sonnemans et al., 1998; van Dijk et.al 2002) use ring-test developed by Liebrand (1984) to measure subjects social value orientations. Based on the ring test subjects are classified as individualistic (only concerned about their own payoff), cooperative (concerned about the sum of own and other's payoff), altruistic (only concerned about the other's payoff), competitive (concerned about the difference between own and other's payoff) or aggressive (only concerned in minimizing the earnings of the other). Van Dijk et. al (2002) find that about half of the subjects concerned about other's interests. Majority of these subjects (38-48%) show positive orientation, i.e. they are willing to sacrifice own resources to the benefit of other. Less than 24 percent of subjects had negative orientation towards others having negative MRS between the other's payoff and own payoff. However, ring test provides only altruism score while our instrument has advantage of measuring reciprocal attitudes in addition to altruism. In our survey, group score measures altruism and grid score measures reciprocity. Note that our instrument measures preferences using attitudinal

questions while other studies use either strategy method based on actual contributions (Kurzban, Houzer, 2005, Fischbacher et. al, 2001 and Gachter et. al, 2003) or allocation choices between the player and other person in the ring test (Liebrand, 1984, Offerman et al., 1996; Sonnemans et al., 1998; van Dijk et.al 2002). Note that the ring test used two-person situations while all others used N-person social dilemma games.

c. Individualism/collectivism questions

Two-role treatment:

Interdependence index was positively correlated with the trusting action in both versions of trust game (censored tobit, p=0.024, p=0.076 respectively). Independence index was negatively correlated with the donations so that individualistic cultural type donates less (p=0.003). Independence attribute was positively correlated with the designator's decision so that individualist were tend to divide larger amount of a dollar since he/she benefits more from larger than a smaller amount (p=0.052).

Interdependence index and grid score were positively correlated.

One-role treatment:

Independence index was positively correlated with the designator's decision to divide dollars (censored tobit, p=0.077). This was because an individualist will benefit from a larger sum of money regardless of how much others are benefiting.

d. Difference between one-role versus two-role treatments:

There was no difference between mean values in the one-role and two-role treatments for all variables across 5 games when we run two-sided ANOVA, or t-test except one variable in the convex version of the bargaining game. The amount of dollars to be divided was higher in the two-role treatment in comparison to one-role treatment in the convex version of ultimatum game (variable if50). For the dividing rule of 50% responders divided more dollars ($9.3 vs $8.57) in the two-role treatments, than responders in the one-role treatment (p=0.0229 two-sided, p=0.0114 one-sided). In the one-sided test, donations were marginally higher in the one-role treatments relative to two-role treatments at 10 % significance level (p=0.0722 one-sided). Furthermore, percent of people trusted in the non-convex version of the trust game was marginally lower in the one-role treatment versus two-role treatment (p=0.056 one-sided). If we are expecting higher other-regarding behavior in the one-role treatment, then the t-statistics for the last test suppose to be positive. However, since it is negative, subjects in the two-role treatment exhibited higher trust and were more pro-social. Average amount of trust and returned amounts were larger in the two-role treatment, not significant though. Also if we expect higher other regarding behavior in the one-role treatment than average acceptable amount suppose to be lower in the one-role treatment, which was not observed. Since these two one-sided tests on donating and trusting behavior have a

marginal significance level (p=0.0722, p=0.056) we rely on two-sided tests and conclude that there was no significant difference between one-role or two-role treatments.

However, cultural measures had no significant power to predict behavior in one-role treatment. This was due to the structure of the one-role design that assigns only either sender role or receiver role in all proposed tasks within the session. Subjects felt unfair with non-symmetric assignment of roles. This unhappiness may have created non-satisfaction, which requested subject to act very selfishly. Several of them suggested at least to alternate roles across games in the feedback they provided after the session. On the other hand, the random payment may induce behavior where subjects to be concerned only about themselves. Unfair situations may promote a sense of egalitarian view and subjects may share feeling of 50:50 as fair and this promoted attitude may reflect the behavior in the one-role treatment. Responders in the one-role treatment will punish more unfair offers than in the two-role treatment. Therefore, given some level of social preferences subjects may assess the situation differently depending on the psychological factors such as mood, intention and context, game setting.

The number of observation in the one-role treatment was N=60 versus N=100 in the two-role treatment. Tobit regression on the same number of observations (60 subjects excluding session 8 and 15) in the two-role treatment shows again that group scores were positively correlated with the offer in the bargaining game and trusted amount in the regular trust game. However, significance level drops by 0.05 points. With smaller sample size for the two-role treatment, in UG (tobit with demographic variables) significance of variable offer drops from 0.013 to 0.059 for the grid score (dep-nt: Offer); from 0.018 to 0.079 for the group score. US citizen variable becomes significant at p=0.067. Minimum acceptable amount is no longer significant. Also correlation b/w designate and a grid score become insignificant. For the dividing rule variable age (p=0.099) and US citizen (p=0.097) becomes sign.-t at 10% level. In the faith game however, group score significance level increases from 0.06 to p=0.02 in the single variable regression; in the tobit with demographic variables from 0.09 to p=0.066 for the group score; age and US citizen variable becomes insignificant. In the trust game age variable significance drops to 0.042 for grid and 0.088 for the group score; US citizen no longer significant. For the returned amount significance of grid disappears in one variable regression. Overall with less data cultural variable significance drops in the two-role treatment, but overall pattern of correlations does not change, that is only ultimatum game and trust games are predicted better with the group score and grid score. Support in Table 2, and 1-role vs. 2-role excel table.

Conclusion

Two-person experiments investigated the mechanism underlying the social preferences. In particular, we investigated motivations for altruistic or reciprocal behavior in the dictator, ultimatum and trust games. Two cultural dimensions (grid and group) to characterize a person are measured using selected items from the WVS. Grid and group

measures were more pronounced in the ultimatum game. In particular, the amounts of giving in the two-role ultimatum game were higher for individuals with higher group scores (higher altruistic score). Furthermore, those with lower grid scores (more reciprocal ones) happen to offer more. As predicted, individuals with higher groupness scores accepted lower offers while individuals with higher grid scores accepted a higher amount. The amount of reciprocal behavior, i.e. to divide fewer dollars as designators in the convex version of the ultimatum game, was prevalent among those with a higher grid score (higher reciprocal score) than among those with lower grid scores.

Comparing results of the two-role and one-role treatments reveals that averages were no different across treatments within each game. However, cultural variables were more pronounced in the two-role treatment ultimatum game whereas demographic variables were more pronounced in the one-role treatment dictator/ultimatum games. This may reflect the asymmetry of roles in the one-role treatment in such a way that inequity may trigger among subjects more egalitarian type of actions.

This research has both practical and methodological implications. Practically, variety of exchange in our life involves two-person relationships when one side decides on the amount of giving/favoring and the other side may reciprocate those decisions. Moreover, dyadic relations serve as a basis of more complex group relations within a team, company, organization or country. Hence, results obtained here may be used for the improvement of social exchange within a group. Methodologically our work provides a tool of investigating the pro-social behavior using general cultural dimensions. If previous studies that use survey measures were more focused mostly on predicting trusting actions, here we provide a tool to measure social attitudes in variety of games. Therefore, our tool capturing general cultural dimensions allows examining social preferences in almost all types of games.

REFERENCE

Andreoni, James, Marco Castillo, Ragan Petrie, 2003. What Do Bargainer's Preferences Look Like? Experiments with a Convex Ultimatum Game. American Economic Review 93 (3), 672-685.

Akerlof, George A.; Kranton, Rachel E., 2005. Identity and the Economics of Organizations. Journal of Economic Perspectives 19 (1/Winter): 9-32.

Akerlof, George and Rachel Kranton, 2000. Economics and Identity, Quarterly Journal of Economics 115 (3): 715–753.

Ahn, T.K., Ostrom, E., Schmidt, D.,Walker, J., 2003. Trust in two-person games: game structures and linkages. In: Ostrom, E., Walker, J. (Eds.), Trust and Reciprocity. Interdisciplinary Lessons From Experimental Research. New York: Russell Sage Foundation, pp. 323–351.

Ashraf, Nava, Iris Bohnet, and Nikita Piankov. 2006. ``Decomposing trust and trustworthiness.'' *Experimental Economics,* 9(3): 193-208.

Bahry, D., and R. Wilson, Ethnicity and trust: Evidence from Russia, in Working papers, Penn State, 2004.

Berg, J., Dickhaut, J., McCabe, K., 1995. Trust, reciprocity, and social history. Games and Economic Behavior 10, 122–142.

Blackwell, Calvin and Michael McKee, 2003. Only for my own neighborhood? Preferences and voluntary provision of local and global public goods. Journal of Economic Behavior and Organization 52, 115-131.

Bernhard Helen, Ernst Fehr, and Urs Fischbacher,2006. Group Affiliation and Altruistic Norm Enforcement. American Economic Review, 96: 217-221

Benjamin, Daniel J., James J. Choi, and A. Joshua Strickland, 2007. Social Identity and Preferences, Working Paper 13309
http://www.nber.org/papers/w13309

Berg, J., J. Dickhaut, and K. McCabe, 1995. Trust, reciprocity, and social history, Games and Economic Behavior, 10: 122–142.

Buchan Nancy R., and Rachel T.A. Croson 2004 The boundaries of trust: own and others' actions in the US and China. Journal of Economic Behavior and Organization, 55: 485-504

Buchan Nancy R., Eric J. Johnson and Rachel T.A. Croson 2005. Let's get personal: An international examination of the influence of communication, culture and social distance on other regarding preferences. Journal of Economic Behavior and Organization, article in press.

Bohnet, I., and Frey, Bruno, 1999. Social distance and other-regarding behavior in dictator games: Comment, American Economic Review, 89 (March): 335-339.

Bowles, S., Gintis, H., 2002. Social capital and community governance. Economic Journal 112, F419–F436.

Capra, C. Mónica, Kelli Lanier, and Shireen Meer, 2008. Attitudinal and Behavioral measures of trust: a New Comparison, working paper

Castro , Massimo Finocchiaro, 2008. Where are you from? Cultural differences in public good experiments. The Journal of Socio-Economics 37: 2319–2329.

Chai, Sun-Ki, 2005. Predicting Ethnic Boundaries. *European Sociological Review.* 21 (4): 375-391.

Chai, Sun-Ki and Aaron Wildavsky, 2003. Culture, Rationality and Violence. In *Politics, Policy and Culture edited by Dennis J. Coyle and Richard J. Ellis* Westview Press, Ch.8.

Chai, Sun-Ki, 1996. A Theory of Ethnic Group Boundaries. *Nations and Nationalism* 2 (2): 281-307.

Chai, Sun-Ki, 1997. Rational Choice and Culture: Clashing Perspectives or Complementary Modes of Analysis? In *Culture Matters: Essay in Honor of Aaron Wildavsky ed. by Richard J. Ellis Michael Thompson.* Boulder Colorado: Westview. Ch.2.

Chuah, Swee-Hoon, Robert Hoffmann, Martin Jones and Geoffrey Williams. ``An economic anatomy of culture: Attitudes and behaviour in inter- and intra-national ultimatum game experiments.'' *Journal of Economic Psychology*, 30 (2009), 732–744.

Cox, James, 2004. Trust and reciprocity: implications of game triads and social context. Journal of Economic Behavior & Organization, 46: 260-281.

Douglas, Mary. 1970. *Natural Symbols: Explorations in Cosmology*. New York: Pantheon

Douglas, Mary and Aaron Wildavsky, 1982. Risk and Culture. *California U.P*.

Danielson, A., and H. Holm, 2007. Do you trust your brethren? Eliciting trust attitudes and trust behavior in a Tanzanian congregation, Journal of Economic Behavior & Organization, 62: 255-271.

Fehr, E., U. Fischbacher, B.v. Rosenbladt, J. Schupp, and G. Wagner, 2002. A nation-wide laboratory -Examining trust and trustworthiness by integrating experiments in representative surveys. Schmollers Jahrbuch, 122: 519-542.

Fershtman, Chaim, and Uri Gneezy, 2001. Discrimination in a segmented society: experimental approach. Quarterly Journal of Economics, Feb., 351-377.

Fischbacher, U., Gächter S. & Fehr E., 2001. Are People Conditionally Cooperative? Evidence from a Public Goods Experiment. Economics Letters 71, 397-404.

Fischbacher, U., & Gächter S., 2003. Heterogeneous Motivations in Contributing to Public Goods. Mimeo, University of St. Gallen.

Fischbacher, Urs, ``z-Tree: Zurich Toolbox for Ready-made Economic Experiments,'' *Experimental Economics*, 10 (2007), 171-178.

Frey, B., & Meier, S. (2004). Pro-social behavior in a natural setting. Journal of Economic Behavior and Organization, 54, 65–88.

Forsythe R., Horowitz J.L., Savin N.E., Selton M. 1994. The statistical analysis of experiments with simple bargaining games. *Games and Economic Behavior* 6, 347-369.

Gächter, S., B. Herrmann, and C. Thöni, 2004. Trust, voluntary cooperation, and socio-economic background: survey and experimental evidence. Journal of Economic Behavior & Organization 55: 505-531.

Gächter, S., Herrmann, B., 2003. Norms of cooperation among urban and rural dwellers. Experimental evidence from Russia. Mimeo, University of St. Gallen.

Gächter, S., Herrmann, B., Thöni, C., 2003. Understanding determinants of social capital: cooperation and informal sanctions in a cross-societal perspective. Mimeo, University of St. Gallen

Glaeser, E. D. Laibson, J. Scheinkman and C. Soutter, 2000. Measuring trust. Quarterly Journal of Economics, 115: 811–846.

Geuth W, Tietz R. 1990. Ultimatum bargaining behavior—a survey and comparison of experimental results. *J. Econ. Psychol.* 11:417–49

Henrich, Hoseph; Boyd, Robert; Bowles, Samuel; Camerer, Colin; Fehr Ernst; Gintis, Herbert and Richard McElreath. (2001). In Search of Homo Economicus: Behavioral Experiments in 15 Small-Scale Societies. American Economic Review 91(2), 73-78.

Henrich, J. R. Boyd, S. Bowles, C. Camerer, E.Fehr, and H. Gintis (eds.) 2004. Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies. Oxford University Press.

B. Herrmann, and C. Thöni, 2009. Measuring conditional cooperation: a replication study in Russia, Experimental Economics 12: 87-92.

Hoffman, E., McCabe, K., & Smith, V., 1994. Preferences, property rights, and anonymity in bargaining games. Games and Economic Behavior, 7: 346-380.

Hoffman, E., McCabe, K., & Smith, V. (1996). Social distance and other regarding behavior in dictator games. American Economic Review, 86, 653–660.

Jin, N., Yamagishi, T. & Kiyonari, T., 1996. Bilateral dependency and the minimal group paradigm. The Japanese Journal of Pshychology 72, 77-85 (in Japanese with an English abstract).

Kurzban, Robert and Daniel Houser 2005, Experiments investigating cooperative types in humans: A complement to evolutionary theory and simulations PNAS 102(5): 1803-1807.

Liebrand,W.B.G., 1984. The effect of social motives, communication and group sizes on behavior in an *n*-person multi stage mixed motive game. European Journal of Social Psychology 14, 239–264.

Ma, Leanne, Katerina Sherstyuk, Malcolm Dowling, Olivier Hill, 2002. Altruism and voluntary provision of public goods. Economics Bulletin, 3, 1−8.

Offerman, T., Sonnemans, J., Schram, A., 1996. Value orientations, expectations and voluntary contributions in public goods. Economic Journal 106, 817–845.

Ostrom, Elinor and James Walker. Trust and Reciprocity: Interdisciplinary Lessons from Experimental Research. Volume VI in the Russel Sage Foundation series on trust, 2003, New York.

Rotter, Julian. 1967. A new scale for the measurement of Interpersonal trust. Journal of Personality 35 (4), 651-665.

Selten, R., 1967. Die Strategiemethode zur Erforschung des eingeschränkt rationalen Verhaltens im Rahmen eines Oligopolexperimentes. In: Sauermann, H. (Ed.), Beiträge zur experimentellen Wirtschaftsforschung. J.C.B. Mohr (Paul Siebeck), Tübingen, pp. 136-168.

Sonnemans, J., Schram, A., Offerman, T., 1998. Public good provision and public bad prevention: the effect of framing. Journal of Economic Behavior and Organization 34, 143–161.

Van Dijk, F., van Winden, F., 1997. Dynamics of social ties and public good provision. Journal of Public Economics 64, 323–341.

Van Dijk, F., Sonnemans, J., van Winden, F., 2002. Social ties in a public good experiment. Journal of Public Economics 85, 275–299.

Yamagishi, Toshio and Midori Yamagishi. 1994. Trust and Commitment in the United States and Japan. Motivation and Emotion 18 (2), 129-166.

Yamagishi, Toshio, Karen S. Cook, and Motoki Watabe. 1998. Uncertainty, Trust, and Commitment Formation in the United States and Japan. American Journal of Sociology 104 (1), 165-194.

Yamagishi, Toshio. 1986. The provision of a sanctioning system as a public good. Journal of Percenality and Social Psychology 32 (3), 446-448.

Yamagishi, Toshio. 2001.Trust as a form of social intelligence. In Trust in Society, edited by Karen S. Cook. New York: Russell Sage Foundation.

Table 1. Summary of experimental sessions

	Treatments	Date	Time	Number of subjects	Number of observations	Session code
One-role Design:	DG, UG, CUG, F, CT					
		05/18/2009	1 -2pm	10	5	2
		05/20/2009	1-2pm	14	7	4
		05/22/2009	1-2pm	10	5	6
		05/28/2009	2-3pm	20	10	7
		05/29/2009	2-3pm	14	7	9
		07/15/2009	3-4pm	16	8	10
		07/21/2009	1-2pm	10	5	12
		07/23/2009	1-2pm	12	6	13
		07/24/2009	1:30-2:30	14	7	14
total				120	60	
Two-role Design:	DG, UG, CUG, F, CT					
		05/18/2009	10-11am	12	12	1
		05/20/2009	10-11am	16	16	3
		05/21/2009	1-2pm	16	16	5
		05/29/2009	11-12pm	20	20	8
		07/17/2009	3-4pm	16	16	11
		07/24/2009	3-4pm	20	20	15
total				100	100	

DG-dictator game, UG-ultimatum game, CUG-convex ultimatum game, F-faith game (binary trust), CT-convex trust game

Table 2. One-role versus two-role

	1-role mean	st.dev.	2-roles mean	st.dev.	p-value 1-role vs. 2-roles two-sided	one-sided
Dictator game:						
offer, $	**3.93**	3.04	**3.32**	2.22	**0.1443**	**0.0722**
Ultimatum bargaining						
offer, $	**4.65**	2.33	**4.48**	2.12	**0.6371**	0.3186
min acceptable, $	**2.50**	1.70	**2.30**	2.07	**0.5292**	0.2646
Trust, non-convex						
% of subjects who trust	**49**		**59**		**0.1120**	**0.0560**
share who returned if trust	**40**		**79**		**0.8451**	0.4225

Table 2 Difference between one-role and two-roles treatments: (excluding Monday (5/18/2009) faith and trust games with m=3)

Mean (st.dev.)	One-role	Two-role	p*-value Ho: one-role= =two-role	p**-value Ho: one-role= =two-role
Donate	**3.93** (3.04)	**3.32** (2.22)	0.1443	0.2707
Offer	**4.65** (2.33)	**4.48** (2.12)	0.6371	0.4178
Minimum	**2.50** (1.70)	**2.30** (2.07)	0.5292	0.2187
Rule	**37.77** (26.57)	**35.67** (18.47)	0.5576	0.9308
Designate	**7.88** (3.58)	**7.64** (3.35)	0.6656	0.3188
Faith	**2.95** (3.03)	**3.55** (2.97)	0.2450	0.2437
dollarfaith	**4.49** (2.77)	**4.49** (2.76)	0.9962	0.9129
Trust	**2.55** (2.49)	**2.85** (2.32)	0.4551	0.5045
dollartrust	**1.24** (2.09)	**1.77** (2.22)	0.1525	0.0662
if1	**5.43** (4.66)	**5.24** (4.56)	0.7969	0.5073
if10	**6.18** (4.35)	**6.14** (4.22)	0.9505	0.5762
if20	**6.45** (4.06)	**6.48** (3.95)	0.9633	0.7721
if30	**7.00** (3.69)	**7.10** (3.41)	0.8620	0.7923
if40	**7.88** (3.10)	**7.77** (2.84)	0.8136	0.5337
if50	**9.33** (1.66)	**8.57** (2.23)	0.0229	0.0123
if60	**8.82** (2.26)	**8.49** (2.32)	0.3847	0.2734
if70	**8.67** (2.66)	**8.45** (2.60)	0.6135	0.2772
if80	**8.65** (2.80)	**8.34** (2.84)	0.5024	0.3762
if90	**8.62** (2.98)	**8.33** (3.00)	0.5585	0.5985
if99	**8.55** (3.32)	**8.21** (3.29)	0.5286	0.2808
if2	**0.35**	**0.47**	0.2334	0.2234

	(0.55)	(0.61)		
if4	**0.73**	**1.08**	0.0529	0.0429
	(0.99)	(1.09)		
if6	**1.31**	**1.84**	0.0220	0.0321
	(1.23)	(1.40)		
if8	**1.98**	**2.59**	0.0396	0.0566
	(1.63)	(1.75)		
if10trust	**2.69**	**3.42**	0.0548	0.0580
	(2.04)	(2.28)		
if12	**4.07**	**4.36**	0.5509	0.4616
	(2.73)	(2.89)		
N (N faith)	60(55)	100 (88)		

*One-way ANOVA

** Wilcoxon-Mann-Whitney test

Table 3 Grid and Group effect: correlations (excluding Monday (5/18/2009) faith and trust games with m=3, all data)

	One-role	**Two-role**	**One-role** Pearson correlation Sig. (2-tailed) N		**Two-role** Pearson correlation Sig. (2-tailed) N	
	Mean (st.dev.)	**Mean (st.dev.)**	**Grid score**	**Group score**	**Grid score**	**Group score**
Donate	**3.93** (3.04)	**3.32** (2.22)	−0.0474 0.7190 60	0.2299 0.0772 60	−0.0903 0.3716 100	0.0242 0.8110 100
Offer	**4.50** (2.44)	**4.48** (2.12)	0.0375 0.7763 60	0.0803 0.5422 60	−0.2035* 0.0423 100	0.2045* 0.0413 100
Minimum	**2.50** (1.70)	**2.30** (2.07)	0.0751 0.5685 60	0.0459 0.7279 60	0.1975* 0.0489 100	−0.1407 0.1628 100
Rule	**37.77** (26.57)	**35.67** (18.47)	−0.0210 0.8734 60	0.0480 0.7159 60	−0.0138 0.8916 100	0.0317 0.7545 100
Designate	**7.88** (3.58)	**7.64** (3.35)	0.0208 0.8747 60	−0.0721 0.5843 60	−0.2847* 0.0041 100	0.1252 0.2144 100
Faith	**2.95** (3.03)	**3.55** (2.97)	−0.0995 0.4699 55	0.1016 0.4603 55	0.0163 0.8801 88	0.2033 0.0574 88
dollarfaith	**4.49** (2.77)	**4.49** (2.76)	−0.0303 0.8262 55	0.3366* 0.0120 55	−0.0993 0.3575 88	0.0819 0.4482 88
Trust	**2.55** (2.49)	**2.85** (2.32)	−0.0842 0.5410 55	0.1472 0.2836 55	0.0106 0.9217 88	0.0641 0.5529 88
dollartrust	**1.24**	**1.77**	−0.1336	−0.0555	−0.2394*	0.1470

	(2.09)	(2.22)	0.3309 0.6874 0.0247 0.1719			
			55	55	88	88
if1	5.43 (4.66)	5.24 (4.56)	0.0044 0.9737 60	−0.1604 0.2208 60	−0.0261 0.7965 100	0.2035* 0.0423 100
if10	6.18 (4.35)	6.14 (4.22)	−0.0106 0.9362 60	−0.2004 0.1247 60	−0.1083 0.2834 100	0.2293* 0.0217 100
if20	6.45 (4.06)	6.48 (3.95)	−0.0136 0.9181 60	−0.2130 0.1023 60	−0.0439 0.6648 100	0.2451* 0.0140 100
if30	7.00 (3.69)	7.10 (3.41)	−0.1323 0.3134 60	−0.1694 0.1958 60	−0.0931 0.3568 100	0.2662* 0.0074 100
if40	7.88 (3.10)	7.77 (2.84)	−0.1465 0.2641 60	−0.2035 0.1189 60	−0.1468 0.1449 100	0.2663* 0.0074 100
if50	9.33 (1.66)	8.57 (2.23)	−0.0068 0.9591 60	−0.0457 0.7291 60	−0.2175* 0.0297 100	0.0990 0.3272 100
if60	8.82 (2.26)	8.49 (2.32)	−0.0454 0.7304 60	−0.2022 0.1212 60	−0.2876* 0.0037 100	0.1145 0.2565 100
if70	8.67 (2.66)	8.45 (2.60)	−0.0619 0.6387 60	−0.2262 0.0822 60	−0.3259* 0.0009 100	0.0851 0.4000 100
if80	8.65 (2.80)	8.34 (2.84)	−0.0658 0.6174 60	−0.2198 0.0916 60	−0.3515* 0.0003 100	0.0877 0.3856 100
if90	8.62 (2.98)	8.33 (3.00)	−0.0649 0.6223 60	−0.1992 0.1270 60	−0.3596* 0.0002 100	0.0685 0.4984 100
if99	8.55 (3.32)	8.21 (3.29)	−0.0812 0.5375 60	−0.0926 0.4814 60	−0.3979* 0.0000 100	0.0546 0.5898 100
if2	0.35 (0.55)	0.47 (0.61)	0.0116 0.9328 55	0.1683 0.2195 55	−0.0270 0.8029 88	0.1027 0.3411 88
if4	0.73 (0.99)	1.08 (1.09)	0.0036 0.9792 55	0.2496 0.0661 55	−0.1090 0.3119 88	0.0239 0.8248 88
if6	1.31 (1.23)	1.84 (1.40)	0.0546 0.6921 55	0.2381 0.0800 55	−0.1210 0.2614 88	0.0845 0.4335 88
if8	1.98 (1.63)	2.59 (1.75)	−0.0395 0.7749 55	0.2270 0.0956 55	−0.1493 0.1650 88	0.0605 0.5754 88
if10trust	2.69 (2.04)	3.42 (2.28)	−0.0415 0.7633 55	0.2744* 0.0426 55	−0.1382 0.1993 88	0.0585 0.5883 88
if12	4.07 (2.73)	4.36 (2.89)	−0.1455 0.2890 55	0.3352* 0.0124 55	−0.1611 0.1338 88	0.0901 0.4037 88
N (N faith)	60(55)	100 (88)				

* significant at 5 % level

Table4. Tobit regression results, two-role treatment:

independent	group score						grid score					
variable:	Coef.	Std. Err.	t	P>t	adj.R^2	N	Coef.	Std. Err.	t	P>t	adj. R^2	N
donate	0.27	2.37	0.12	0.908	0.01	88	-1.22	1.67	-0.73	0.467	0.02	88
offer	4.63	1.92	2.42	0.018	0.06	88	-3.43	1.35	-2.54	0.013	0.07	88
minimum	-4.34	1.81	-2.40	0.019	0.03	88	2.15	1.31	1.64	0.104	0.02	88
rule	-1.66	18.15	-0.09	0.928	0.00	88	-3.98	12.80	-0.31	0.757	0.02	88
designate	4.10	3.17	1.29	0.199	0.01	88	-6.20	2.18	-2.84	0.006	0.04	88
faith	7.86	4.46	1.76	0.082	0.02	88	2.19	2.97	0.74	0.464	0.00	88
return in faith	3.15	3.06	1.03	0.306	0.14	78	-1.10	2.05	-0.54	0.593	0.09	78
trust	1.91	3.11	0.61	0.542	0.13	78	1.19	2.07	0.58	0.567	0.11	78
return in trust	5.81	5.00	1.16	0.249	0.09	78	-5.33	3.43	-1.55	0.125	0.01	78

Table 5. Difference between cultural types: compare mean across sessions (grid score 0.41, group score 0.5)

mean/stdev	One-role treatment				p*-value one-role	p*-value	p*-value	Two-role treatment				p*-value two-role	p*-value	p*-value
	LH	LL	High-grid	All				LH	LL	High-grid	All			
					Ho: LH=LL	Ho: LH=High-grid	Ho: LL=High-grid					Ho: LH=LL	Ho: LH=High-grid	Ho: LL=High-grid
Grid	0.27	0.27	0.57	0.40				0.26	0.32	0.55	0.41			
	0.09	0.08	0.1	0.17				0.1	0.07	0.11	0.17			
Group	0.6	0.4	0.51	0.49				0.6	0.4	0.49	0.51			
	0.08	0.07	0.13	0.13				0.08	0.07	0.11	0.12			
donate	5.53	3.05	3.74	3.93	0.0234	0.0922	0.4697	3.48	3.57	3.1	3.32	0.7483	0.3768	0.7488
	2.8	3.03	2.91	3.04	>	>		2.43	2.23	2.11	2.22			
offer	4.87	4.5	4.65	4.65	0.3791	0.9578	0.4094	5.1	4.24	4.19	4.48	0.1201	0.1269	0.9358
	2	2.43	2.53	2.33				2.04	2.1	2.14	2.12			
minimum	2.86	1.94	2.63	2.5	0.5613	0.8846	0.3516	1.77	2.14	2.71	2.3	0.7715	0.3749	0.5637
	1.46	1.65	1.81	1.7				1.78	1.59	2.36	2.07			
rule	38.1	39.1	36.2	37.8	0.4987	0.9580	0.4397	37.8	32.5	35.7	35.7	0.3094	0.2482	0.4678
	25.5	25.6	29.2	26.6				17.1	21.0	18.4	18.5			
designate	7.36	7.94	8.1	7.88	0.8346	1.0000	0.6489	8.1	8.7	6.9	7.6	0.3324	0.5211	0.0916
	4.4	3.66	3.22	3.58				3.26	2.99	3.44	3.35			>
faith	4.29	2.67	2.35	2.95	0.3835	0.0799	0.5202	3.93	2.53	3.75	3.55	0.1363	0.8335	0.1412
	2.81	3.07	2.99	3.03		>		2.9	3.04	2.94	2.97			
dollarfaith	5.77	4.13	4.07	4.49	0.4128	0.1172	0.4299	4.97	4.58	4.1	4.49	0.6752	0.1745	0.7540
	2.74	3	2.56	2.77				2.37	3.37	2.72	2.76			
trust	3.21	2.44	2.22	2.55	1.0000	0.5211	0.4271	2.83	2.32	3.13	2.85	0.2948	0.5296	0.2506
	2.61	2.87	2.09	2.49				2.42	2.4	2.21	2.32			
dollartrust	1.23	1.6	1.04	1.24	0.2697	0.1505	0.6605	2.45	1.42	1.45	1.77	0.1719	0.0917	0.6015
	2.49	2.44	1.7	2.09				2.52	2.14	1.95	2.22		>	
if1	5.08	5.94	5.3	5.43	0.5859	0.8468	0.6877	5.1	5.19	5.35	5.24	0.9360	0.8723	0.6304
	4.92	4.63	4.69	4.66				4.79	4.68	4.44	4.56			
if10	6	6.41	6.13	6.18	1.0000	0.6984	0.7546	6.39	6.48	5.83	6.14	0.8726	0.7488	0.5738
	4.67	4.44	4.3	4.35				4.39	4.31	4.14	4.22			

if20	6.15	6.65	6.47	6.45	1.0000	0.8085	0.7547	6.45	6.62	6.44	6.48	0.6310	0.6310	0.6310
	4.52	4.21	3.89	4.06				4.16	4.33	3.72	3.95			
if30	7.92	6.76	6.73	7.00	0.3872	0.0878	0.8233	7.39	7.29	6.83	7.1	0.8717	0.2590	0.6304
	3.45	4.1	3.61	3.69		>		3.53	3.72	3.24	3.41			
if40	8.38	7.94	7.63	7.88	0.6276	0.1274	0.3674	8.32	8.05	7.29	7.77	0.7483	0.2290	0.2963
	3.31	3.03	3.12	3.1				2.66	3.2	2.76	2.84			
if50	9.62	9.18	9.3	9.33	0.3005	0.2100	0.9599	8.94	9.52	7.92	8.57	0.1841	0.4225	0.0156
	1.39	1.85	1.7	1.66				2.21	1.29	2.39	2.23			>
if60	9.15	8.59	8.8	8.82	0.4306	0.2109	0.9631	9.16	9.38	7.67	8.49	0.4673	0.0374	0.0064
	2.15	2.35	2.31	2.26				1.95	1.32	2.6	2.32		>	>
if70	9.15	8.41	8.6	8.67	0.3677	0.2112	0.7816	9.26	9.67	7.4	8.45	0.1906	0.0301	0.0037
	2.08	3.2	2.61	2.66				1.88	1.11	3.04	2.6		>	>
if80	9.15	8.35	8.6	8.65	0.3677	0.1753	0.7457	9.39	9.52	7.15	8.34	0.3051	0.0446	0.0043
	2.08	3.41	2.75	2.8				1.93	1.5	3.29	2.84		>	>
if90	9.15	8.29	8.57	8.62	0.4306	0.1756	0.7463	9.42	9.52	7.1	8.33	0.5922	0.0360	0.0225
	2.08	3.65	2.96	2.98				1.93	1.5	3.56	3		>	>
if99	9.23	8.24	8.43	8.55	0.5907	0.3980	0.8801	9.48	9.52	6.81	8.21	0.7210	0.0156	0.0145
	1.88	3.93	3.48	3.32				1.84	1.5	3.97	3.29		>	>
if2	0.33	0.44	0.3	0.35	0.3262	0.8541	0.3564	0.52	0.26	0.52	0.47	0.0336	0.8320	0.0174
	0.49	0.73	0.47	0.55				0.57	0.45	0.68	0.61	>		<
if4	0.75	0.88	0.63	0.73	0.4642	0.9527	0.5877	1.14	1	1.08	1.08	0.5271	0.4020	1.0000
	0.97	1.2	0.88	0.99				1.16	1.15	1.02	1.09			
if6	1.5	1.31	1.22	1.31	0.8602	0.5546	0.7471	2	1.68	1.8	1.84	0.1150	1.0000	0.5970
	1.24	1.25	1.25	1.23				1.31	1.53	1.42	1.4			
if8	1.5	1.31	1.22	1.98	0.7254	0.5233	0.5600	2	1.68	1.8	2.59	0.1161	0.5296	0.9166
	1.78	1.67	1.56	1.63				1.47	2.26	1.71	1.75			
if10trust	3.33	2.75	2.37	2.69	0.8153	0.1458	0.5603	3.66	3.63	3.15	3.42	0.1412	0.2087	0.9166
	2.02	2.11	2	2.04				1.88	2.91	2.25	2.28			
if12	5.5	4.13	3.41	4.07	0.4470	0.0624	0.2459	4.86	4.53	3.92	4.36	0.1127	0.1693	1.0000
	2.84	2.73	2.52	2.73		>		2.1	3.41	3.12	2.89			
N				60							100			
(N*)				55							88			

*-Wilcoxon-Mann-Whitney test that compares session averages across typologies

Table 6a. Tobit regression results, one-role treatment:

independent	group score						grid score					
variable:	Coef.	Std. Err.	t	P>t	adj.R^2	N	Coef.	Std. Err.	t	P>t	adj. R^2	N
donate	4.34	4.38	0.99	0.326	0.08	57	-1.44	2.83	-0.51	0.614	0.11	57
offer	0.68	2.74	0.25	0.804	0.18	57	0.88	1.75	0.50	0.619	0.17	57
minimum	-1.37	2.28	-0.60	0.551	0.00	52	1.53	1.46	1.05	0.298	0.00	52
rule	-10.5	40.64	-0.26	0.797	0.20	57	-5.53	25.96	-0.21	0.832	0.20	57
designate	-5.17	4.93	-1.05	0.300	0.07	52	1.24	3.17	0.39	0.697	0.07	52
faith	-1.96	7.55	-0.26	0.796	0.16	52	-7.88	4.61	-1.71	0.094	0.11	52
return in faith	7.63	3.62	2.11	<mark>0.041</mark>	0.00	48	-0.46	2.50	-0.19	0.853	0.00	48
trust	2.14	4.98	0.43	0.670	0.08	52	-3.44	3.08	-1.12	0.270	0.12	52
return in trust	-2.10	8.37	-0.25	0.803	0.02	48	-3.51	5.69	-0.62	0.540	0.01	48

Table 6b. Tobit regression results, one-role treatment:

independent	group score				Adj.		grid score				Adj.	
variable:	Coef.	Std. Err.	t	P>t	R^2	N	Coef.	Std. Err.	t	P>t	R^2	N
Dictator Game: Dependent variable-donate from the sender												
donate					0.08	57					0.11	57
groupscore	4.34	4.38	0.99	0.33			-1.44	2.83	-0.51	0.61		
gender	-1.87	0.98	-1.92	0.06			-2.03	0.99	-2.05	0.05		
edu	-0.18	0.47	-0.39	0.70			-0.11	0.46	-0.24	0.81		
age	0.20	0.07	2.70	0.01			0.23	0.07	3.13	0.00		
uscitizen	3.07	1.15	2.66	0.01			3.32	1.15	2.89	0.01		
_cons	-4.23	3.12	-1.35	0.18			-2.56	3.17	-0.81	0.42		
Ultimatum Game Non-Convex: Dependent Var.-Offer from the sender												
offer					0.18	57					0.17	57
groupscore	0.68	2.74	0.25	0.80			0.88	1.75	0.50	0.62		
gender	-0.99	0.61	-1.63	0.11			-0.97	0.61	-1.59	0.12		
edu	-0.56	0.30	-1.87	0.07			-0.53	0.29	-1.81	0.08		
age	0.15	0.05	3.23	0.00			0.15	0.04	3.46	0.00		
uscitizen	1.35	0.72	1.88	0.07			1.37	0.71	1.94	0.06		
_cons	2.22	1.95	1.14	0.26			2.01	1.97	1.02	0.31		
Faith Game-Non convex: Dollar sender												
faith					0.16	52					0.11	52
groupscore	-1.96	7.55	-0.26	0.80			-7.88	4.61	-1.71	0.09		
gender	-3.36	1.66	-2.02	0.05			-3.78	1.64	-2.31	0.03		
edu	0.00	0.85	0.00	1.00			-0.26	0.82	-0.32	0.75		
age	0.21	0.13	1.57	0.12			0.22	0.12	1.94	0.06		
uscitizen	2.42	2.00	1.21	0.23			2.32	1.86	1.24	0.22		
_cons	-3.63	5.31	-0.68	0.50			-0.50	5.29	-0.09	0.93		
Faith Game-Non convex: Dollar send back from receiver												
dollarfaith					0.00	48					0.00	48
groupscore	7.63	3.62	2.11	0.04			-0.46	2.50	-0.19	0.85		
gender	0.59	0.86	0.68	0.50			0.02	0.86	0.02	0.98		
edu	-0.14	0.40	-0.36	0.72			-0.12	0.42	-0.30	0.77		
age	-0.01	0.07	-0.12	0.90			0.04	0.07	0.56	0.58		
uscitizen	-1.14	1.03	-1.11	0.28			-1.15	1.08	-1.07	0.29		
_cons	1.87	2.51	0.75	0.46			4.82	2.50	1.93	0.06		
Trust Game- convex: Dollar sender												
trust					0.08	52					0.12	52
groupscore	2.14	4.98	0.43	0.67			-3.44	3.08	-1.12	0.27		
gender	-1.76	1.11	-1.59	0.12			-2.03	1.10	-1.84	0.07		
edu	-0.22	0.56	-0.40	0.69			-0.26	0.55	-0.48	0.64		
age	0.11	0.09	1.27	0.21			0.15	0.08	1.83	0.07		
uscitizen	2.57	1.37	1.87	0.07			2.75	1.31	2.11	0.04		
_cons	-2.59	3.57	-0.73	0.47			-0.76	3.61	-0.21	0.83		

Table 7. Difference between cultural types: compare mean across typologies (grid score 0.41, group score 0.5)

mean/ stdev	One-role treatment LH	LL	High -grid	All	p*-value one-role	p*-value	p*-value	Two-role treatment LH	LL	High -grid	All	p*-value two-role	p*-value	p*-value
					Ho: LH=LL	Ho: LH= High-grid	Ho: LL= High-grid					Ho: LH=LL	Ho: LH= High-grid	Ho: LL= High-grid
Grid	0.27	0.27	0.57	0.40				0.26	0.32	0.55	0.41			
	0.09	0.08	0.1	0.17				0.1	0.07	0.11	0.17			
Group	0.6	0.4	0.51	0.49				0.6	0.4	0.49	0.51			
	0.08	0.07	0.13	0.13				0.08	0.07	0.11	0.12			
donate	5.53	3.05	3.74	3.93	0.0304	0.0574	0.7177	3.48	3.57	3.1	3.32	0.6098	0.3903	0.7809
	2.8	3.03	2.91	3.04	>	>		2.43	2.23	2.11	2.22			
offer	4.87	4.5	4.65	4.65	0.7776	0.5782	0.7937	5.1	4.24	4.19	4.48	0.0375	0.0526	0.7658
	2	2.43	2.53	2.33				2.04	2.1	2.14	2.12	>	>	
minimum	2.86	1.94	2.63	2.5	0.1183	0.6126	0.1456	1.77	2.14	2.71	2.3	0.6160	0.1429	0.3042
	1.46	1.65	1.81	1.7				1.78	1.59	2.36	2.07			
rule	38.1	39.1	36.2	37.8	1	0.3928	0.1880	37.8	32.5	35.7	35.7	0.0664	0.5302	0.2038
	25.5	25.6	29.2	26.6				17.1	21.0	18.4	18.5	>		
designate	7.36	7.94	8.1	7.88	1	0.8545	0.9572	8.13	8.67	6.88	7.64	0.3090	0.1722	0.0114
	4.4	3.66	3.22	3.58				3.26	2.99	3.44	3.35			>
faith	4.29	2.67	2.35	2.95	0.1053	0.0292	0.5979	3.93	2.53	3.75	3.55	0.0918	0.7082	0.0983
	2.81	3.07	2.99	3.03		>		2.9	3.04	2.94	2.97	>		<
dollarfaith	5.77	4.13	4.07	4.49	0.1230	0.2063	1	4.97	4.58	4.1	4.49	0.6400	0.1860	0.6028
	2.74	3	2.56	2.77				2.37	3.37	2.72	2.76			
trust	3.21	2.44	2.22	2.55	0.2983	0.0957	0.4134	2.83	2.32	3.13	2.85	0.2681	0.6445	0.0666
	2.61	2.87	2.09	2.49		>		2.42	2.4	2.21	2.32			<
dollartrust	1.23	1.6	1.04	1.24	0.4199	0.6688	0.6789	2.45	1.42	1.45	1.77	0.1484	0.1240	0.7318
	2.49	2.44	1.7	2.09				2.52	2.14	1.95	2.22			

*-Wilcoxon ranks sum test that compares mean across typologies

Figure 1. Offers in dictator game, one-role treatment, N=60
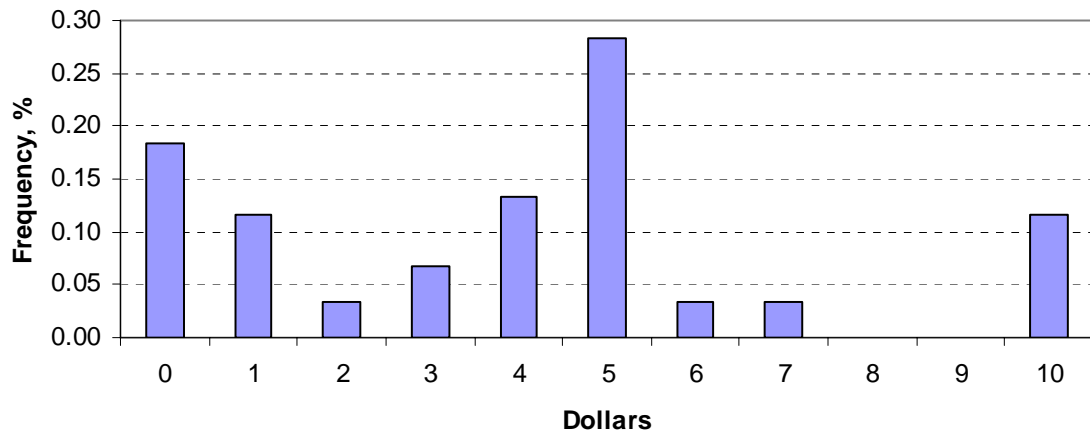
Figure 2. Offers in dictator game, two-role treatment, N=100
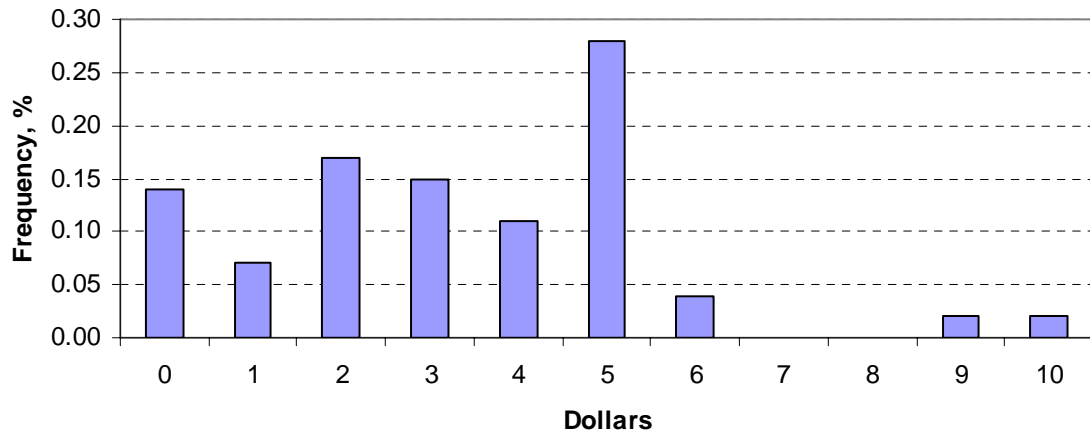
Figure3. Offers in ultimatum game, one-role
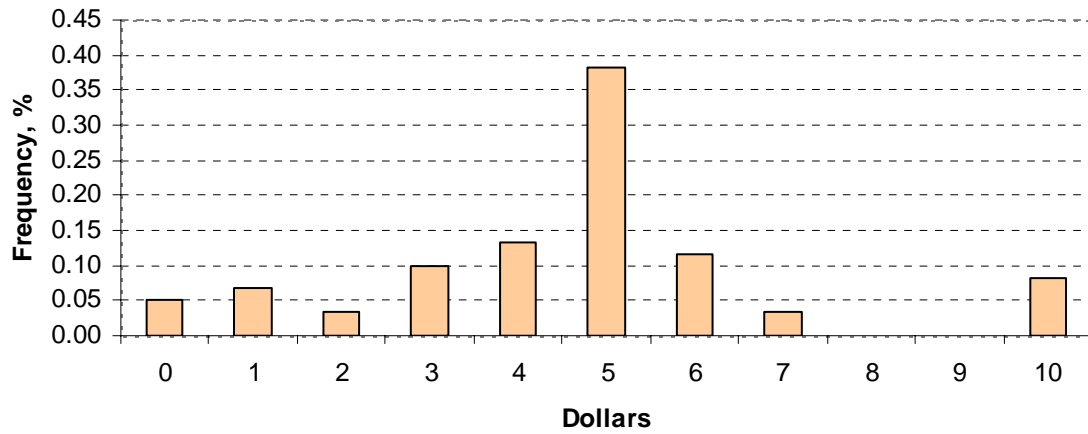
Figure 4. Offers in ultimatum game, two-role
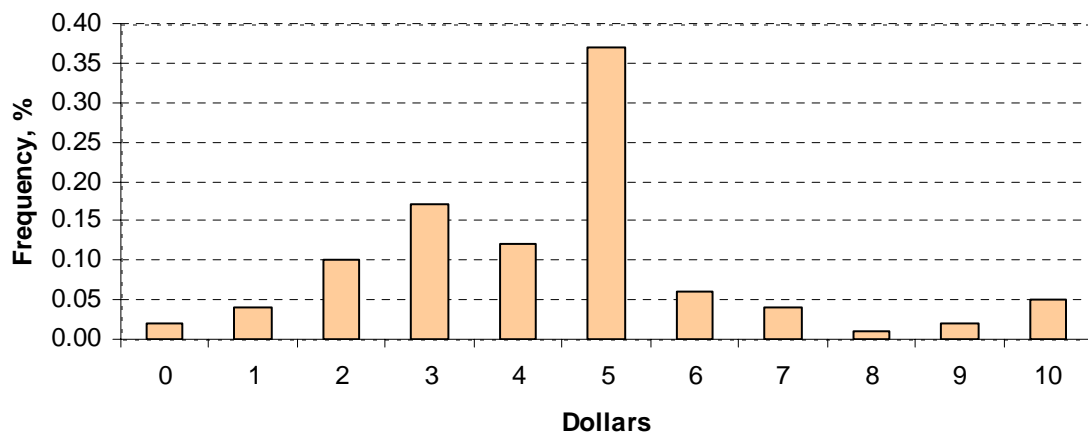
Figure 5. Acceptable amount in ultimatum game, one-role treatment

Figure 6. Acceptable amount in ultimatum game, two-role treatment

**Figure 7. Offers in convex ultimatum game,
one-role treatment**
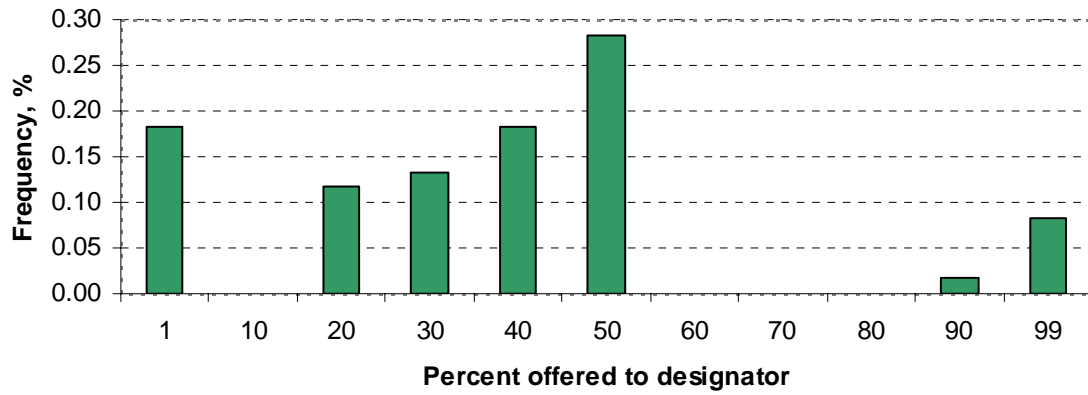
Figure 8. Offers in convex ultimatum game, two-role
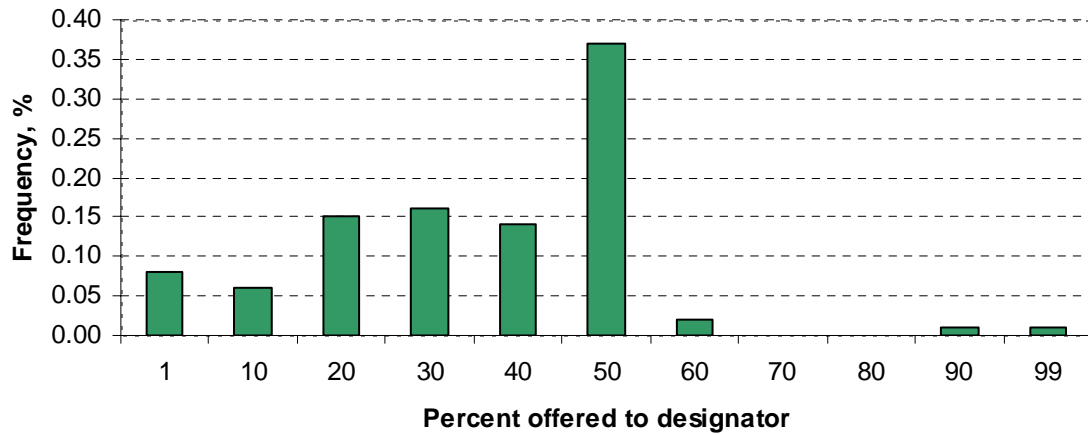
Figure 9. Offers in standard vs. convex ultimatum games, one-role treatment
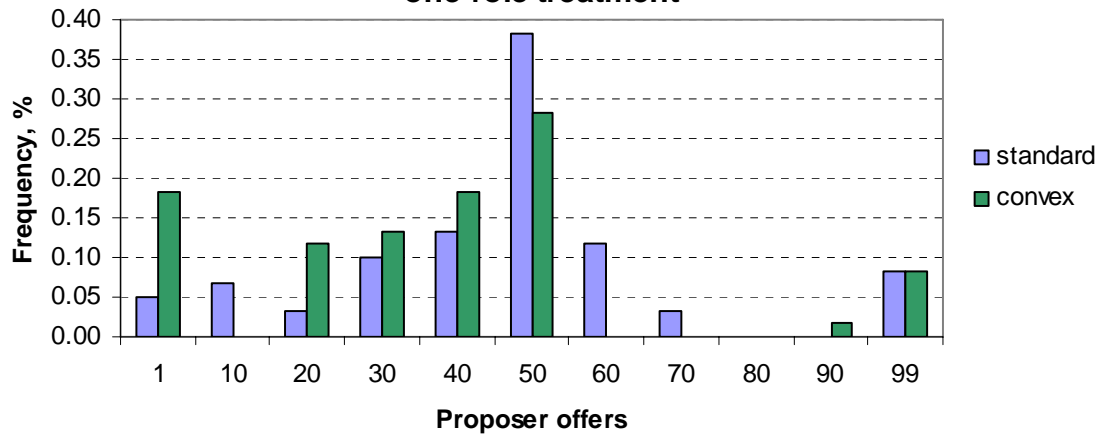
Figure 10. Offers in standard vs. convex ultimatum games, two-role treatment
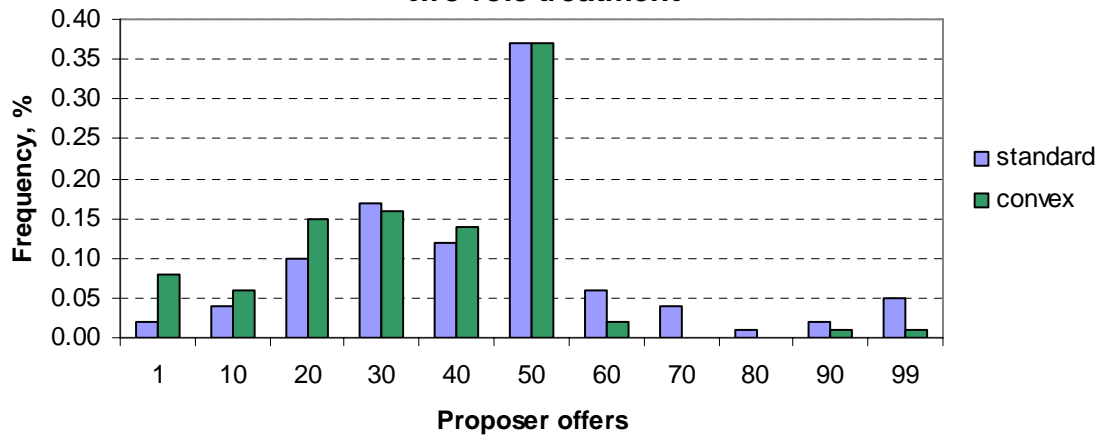
**Amount to divide in convex ultimatum game,
one-role treatment**
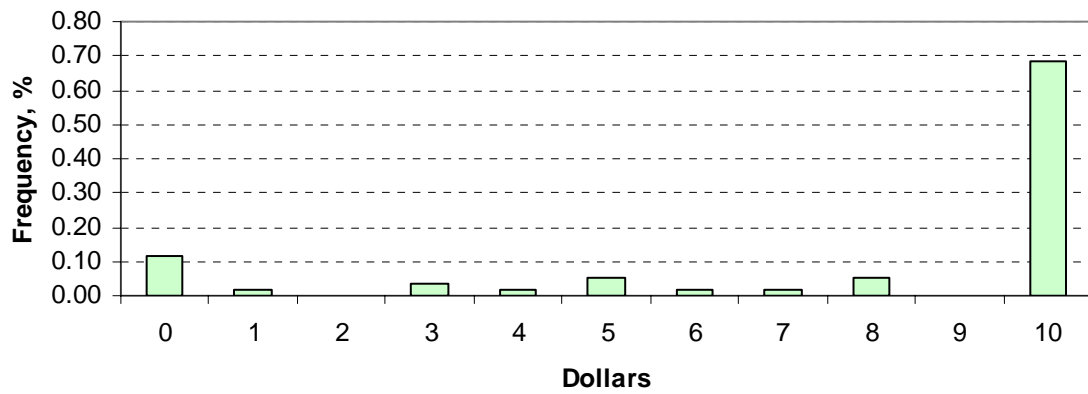
**Amount to divide in convex ultimatum game,
two-role treatment**
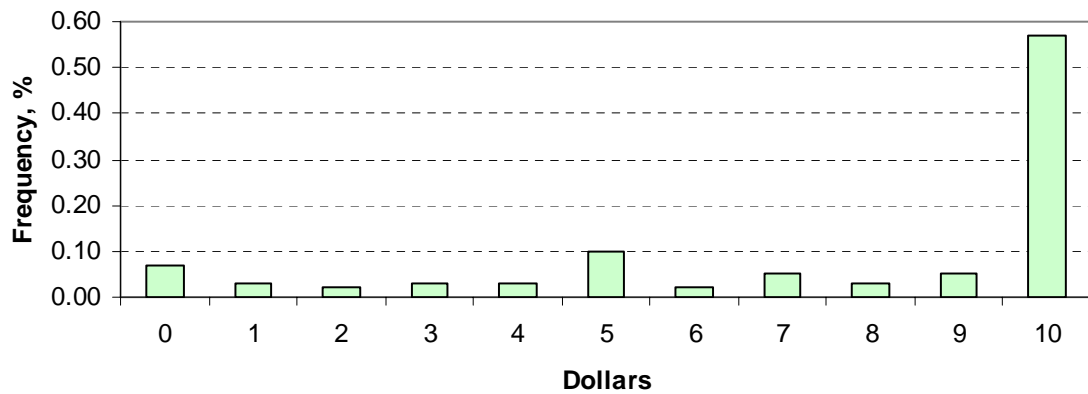
Figure 11. Rejections in convex ultimatum game, one-role treatment
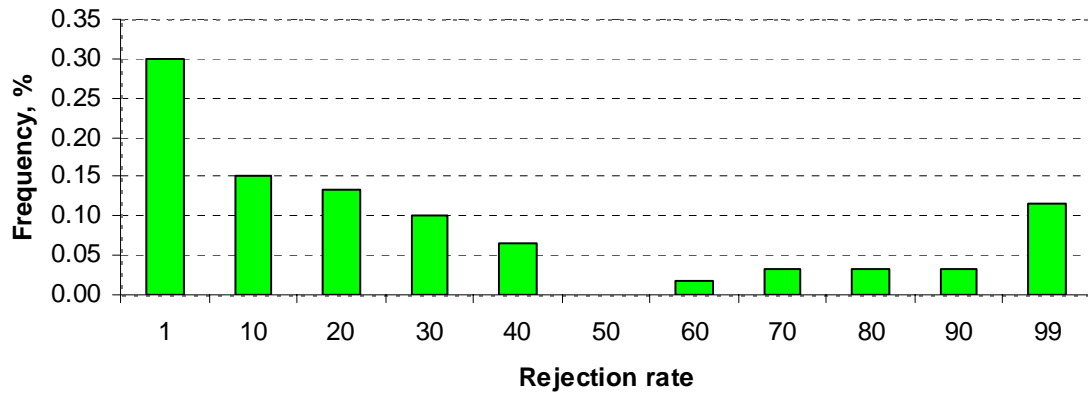
Figure 12. Rejections in convex ultimatum game, two-role treatment
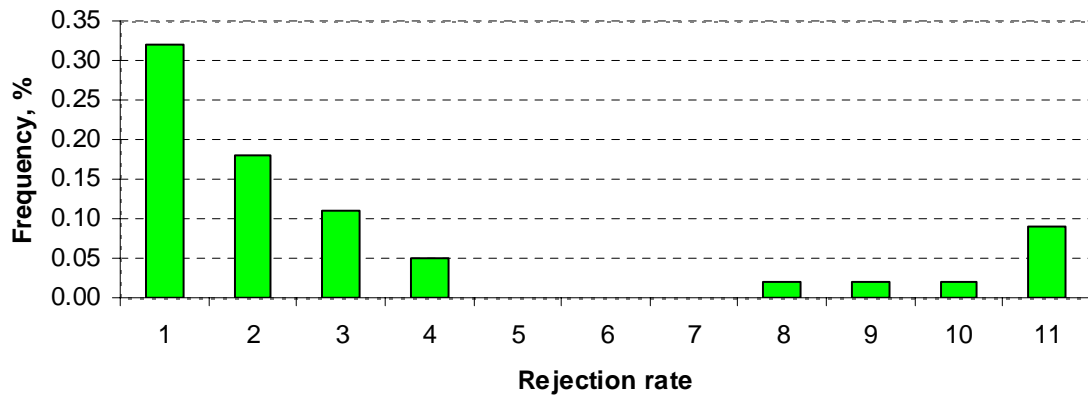
Figure 13. Offers and rejections in convex ultimatum game, one-role treatment
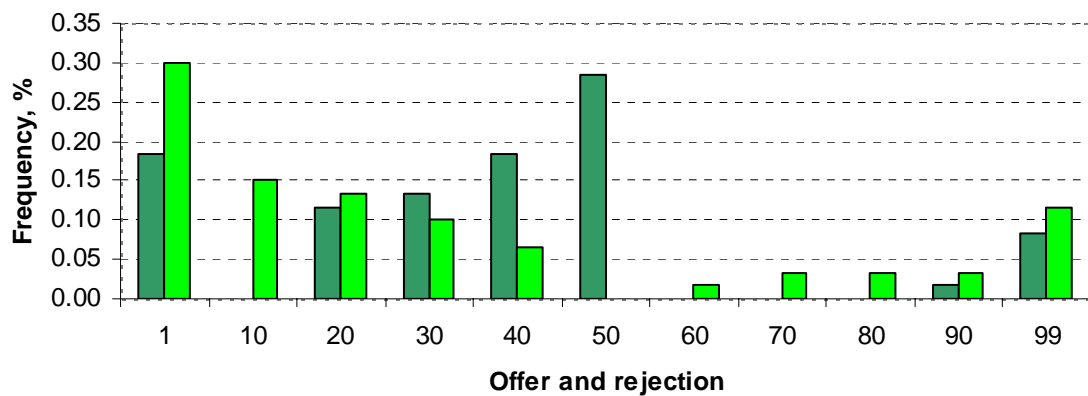
Figure 14. Offers and rejections in convex ultimatum game, two-role treatment
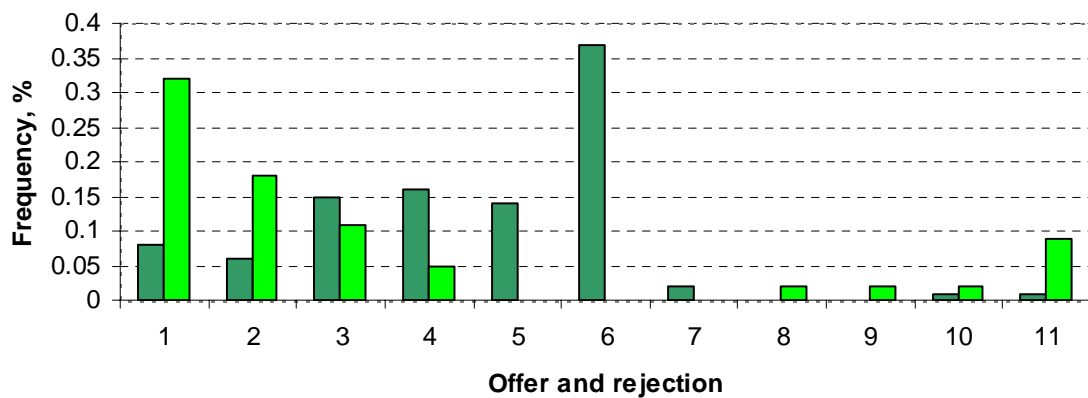
**Figure 15. Amount returned in faith game,
one-role treatment**
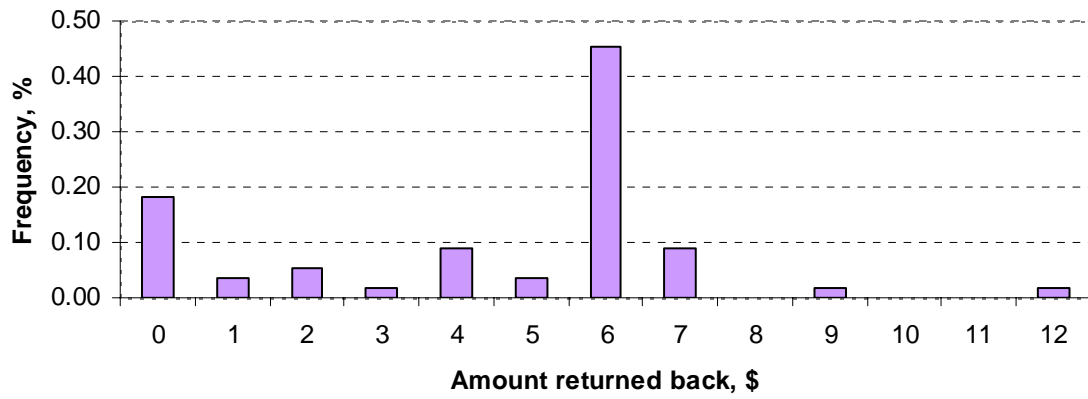
**Figure 16. Amount returned in faith game,
two-role treatment**
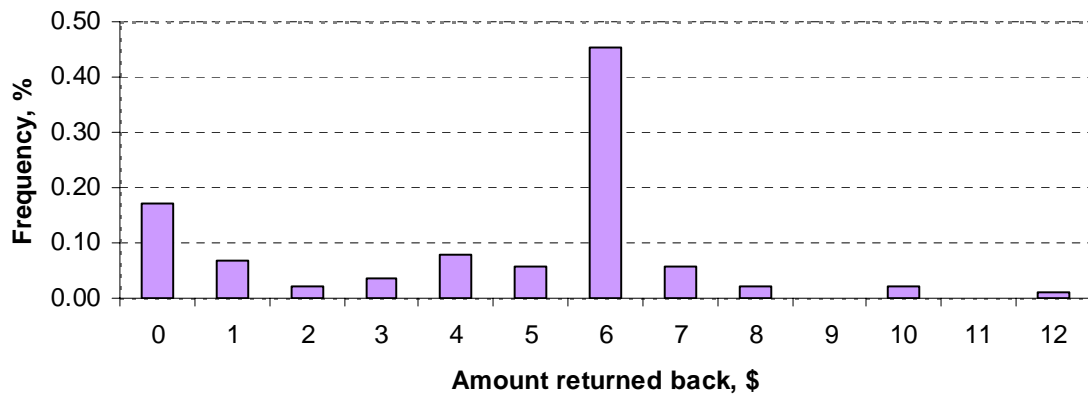
Figure 15. Amount trusted in the trust game, one-role treatment
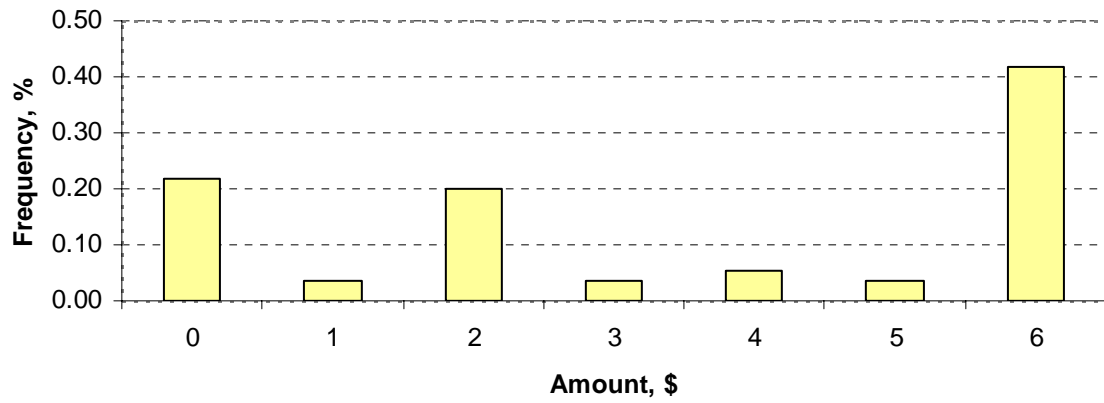
Figure 16. Amount trusted in the trust game, one-role treatment
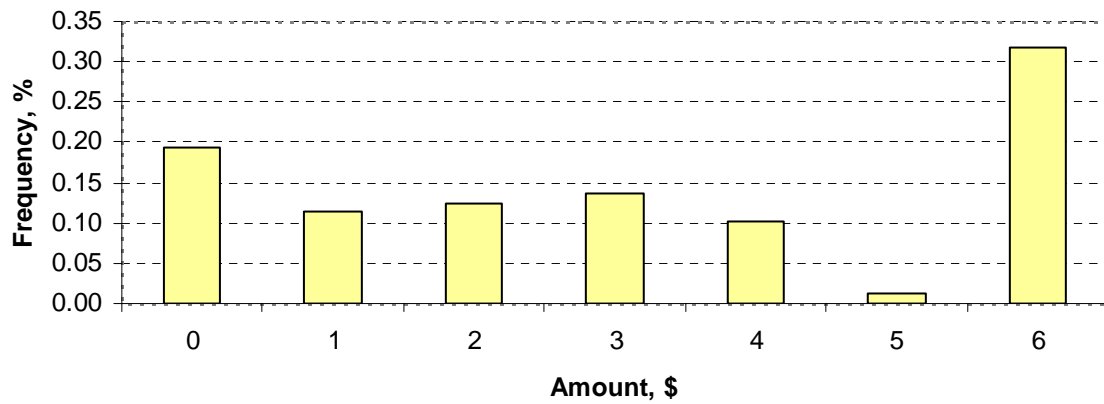
Figure 17. Amount returned in the standard vs. convex trust games, one-role treatment
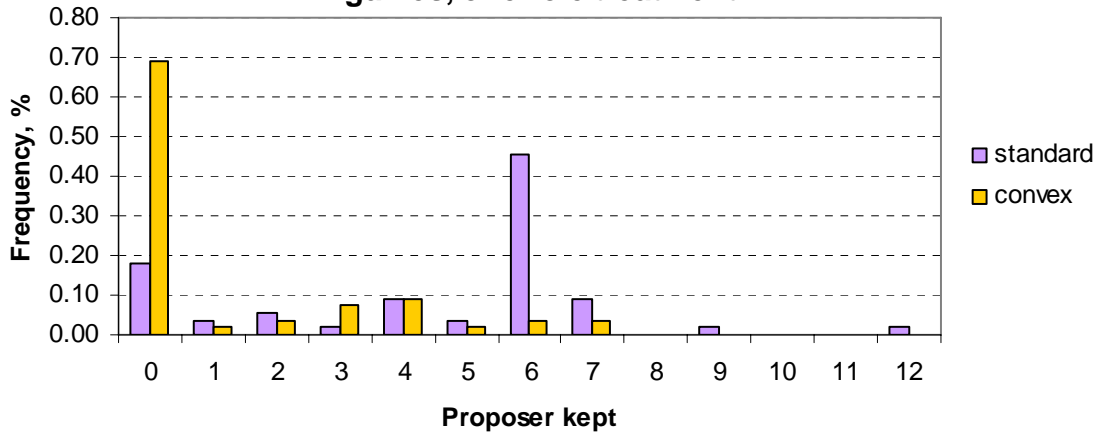
Figure 18. Amount returned in the standard vs. convex trust games, one-role treatment

Appendix A (in-lab survey)

INFORMATION

Study Title: Impact of Cultural Factors in Human Performance
Study Investigator: Dr. Sun-Ki Chai
Department of Sociology, University of Hawaii, 2424 Maile Way, Saunders Hall 247, Honolulu, Hawaii 96822.   Phone: 956-7234. Email: sunki@hawaii.edu.

Purpose

This study is designed to examine the role of culture in group decision-making. In particular, we would like to examine from a scientific basis how people's cultural background influences the decisions that they make in groups. Your participation is voluntary. However, your participation is very important for the success of the study. You are encouraged to answer all questions as truthfully as possible. If you have questions regarding this research, please contact the study investigator at the number or email listed above.

Confidentiality

All information collected will be kept confidential to the extent allowed by law. The survey is anonymous, and does not contain any identifying information that can link you to your responses. The results of this research project may be published, but only the combined data from all participants will be made public, not data on individuals. However, the University of Hawaii's Committee on Human Studies has the authority to review research records.

Risks and Benefits of Participation

There will be no risks associated with participation in the survey. Participants will be given access to the aggregate results of the study data. Data generated from this study will contribute to better understanding of the role of culture in group decision.

Additional Inquiries

If you cannot obtain satisfactory answers to your questions or have comments or complaints about your treatment in this research project, contact: Committee on Human Studies, University of Hawaii, 2540 Maile Way, Honolulu, Hawaii 96822; Phone: 956-5007

_____

SURVEY QUESTIONS

Please say, for each of the following, how important it is in your life. Would you say...

	Very Important	Rather Important	Not Very Important	Not at all Important
1. Family	1	2	3	4
2. Friends	1	2	3	4
3. Religion	1	2	3	4

4. With which of these two statements do you tend to agree?

       1. Regardless of what the qualities and faults of one's parents are, one must always love and respect them
       2. One does not have the duty to respect and love parents who have not earned it by their behavior and attitudes

5. Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?
       1. Most people can be trusted
       2. Can't be too careful (have to be very careful)

Do you agree or disagree with the following statements?

	Agree	Neither	Disagree
6. When jobs are scarce, men should have more right to a job than women	1	2	3
7. When jobs are scarce, older people should be forced to retire from work early	1	2	3

8. Imagine two secretaries, of the same age, doing practically the same job. One finds out that the other earns considerably more than she does. The better paid secretary, however, is quicker, more efficient and more reliable at her job. In your opinion, is it fair or not fair that one secretary is paid more than the other?
       1. Fair
       2. Not fair

9. There is a lot of discussion about how business and industry should be managed. Which of these four statements comes closest to your opinion?
       1. The owners should run their business or appoint the managers
       2. The owners and the employees should participate in the selection of managers
       3. The government should be the owner and appoint the managers
       4. The employees should own the business and should elect the managers

10. People have different ideas about following instructions at work. Some say that one should follow one's superior's instructions even when one does not fully agree with them. Others say that one should follow one's superior's instructions only when one is convinced that they are right. With which of these two opinions do you agree?
       1. Should follow instructions
       2. Depends
       3. Must be convinced first

11. Do you think that a woman has to have children in order to be fulfilled or is this not necessary?
       1. Needs children
       2. Not necessary

The following items contain a list of various changes in our way of life that might take place in the near future. Please tell me for each one, if it were to happen, whether you think it would be a good thing, a bad thing, or don't you mind?

	Good	Don't mind	Bad
12. Less emphasis on money and material possessions	1	2	3

13. Less importance placed
on work in our lives   1   2   3

14. More emphasis on the
development of technology   1   2   3

15. Greater respect for authority   1   2   3

For the following questions, please place your views along the accompanying scale. 1 means you agree completely with the first statement; 10 means you agree completely with the second statement; and if your views fall somewhere in between, you can choose any number in between.

16.   1. Private ownership of business and industry should be increased
           10. Government ownership of business and industry should be increased

           1   2   3   4   5   6   7   8   9   10

17.   1. The government should take more responsibility to ensure that everyone is provided for
           10. People should take more responsibility to provide for themselves

           1   2   3   4   5   6   7   8   9   10

18. How important is God in your life? Please use this scale to indicate - 10 means very important and 1 means not at all important.

           1   2   3   4   5   6   7   8   9   10
           Not at all   Very

Please tell me for each of the following statements whether you think it can always be justified, never be justified, or something in between, using this card.

	Never Justifiable	**Always Justifiable**
19. Homosexuality	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	
20. Prostitution	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	
21. Abortion	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	
22. Divorce	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	

Appendix B (online survey)

Here is the Leung & Kim's (1997) Revised Self-Construal scale.
I treat independence and interdependence as separate dimensions.
The data so far indicate more orthogonal relationship, rather than
polar opposites.

Section 1
Directions: Using the scale below, indicate to what degree you
disagree/agree with each statement provided.

It may be helpful to think of "groups" as your peer group.
*1. I should be judged on my own merit.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*2. I voice my opinions in group discussions.
strongly disagree 1 2 3 4 5 6 7 strongly agree
3. I feel uncomfortable disagreeing with my group.
strongly disagree 1 2 3 4 5 6 7 strongly agree
4. I conceal my negative emotions so I won't cause unhappiness among
the
members of my group.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*5. My personal identity, independent of others, is very important to
me.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*6. I prefer to be self-reliant rather than dependent on others.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*7. I act as a unique person, separate from others.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*8. I don't like depending on others.
strongly disagree 1 2 3 4 5 6 7 strongly agree
9. My relationships with those in my group are more important than my
personal accomplishments.
strongly disagree 1 2 3 4 5 6 7 strongly agree
10. My happiness depends on the happiness of those in my group.
strongly disagree 1 2 3 4 5 6 7 strongly agree
11. I often consider how I can be helpful to specific others in my
group.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*12. I take responsibility for my own actions.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*13. It is important for me to act as an independent person.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*14. I have an opinion about most things: I know what I like and I know
what
I don't like.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*15. I enjoy being unique and different from others.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*16. I don't change my opinions in conformity with those of the
majority.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*17. Speaking up in a work/task group is not a problem for me.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*18. Having a lively imagination is important to me.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*19. Understanding myself is a major goal in my life.
strongly disagree 1 2 3 4 5 6 7 strongly agree
*20. I enjoy being admired for my unique qualities.
strongly disagree 1 2 3 4 5 6 7 strongly agree
21. I am careful to maintain harmony in my group.
strongly disagree 1 2 3 4 5 6 7 strongly agree
22. When with my group, I watch my words so I won't offend anyone.
strongly disagree 1 2 3 4 5 6 7 strongly agree
23. I would sacrifice my self-interests for the benefit of my group.
strongly disagree 1 2 3 4 5 6 7 strongly agree
24. I try to meet the demands of my group, even if it means controlling
my

```
own desires.
strongly disagree 1 2 3 4 5 6 7 strongly agree
25. It is important to consult close friends and get their ideas before
making decisions.
strongly disagree 1 2 3 4 5 6 7 strongly agree
26. I should take into consideration my parents' advice when making
education and career plans.
strongly disagree 1 2 3 4 5 6 7 strongly agree
27. I act as fellow group members prefer I act.
strongly disagree 1 2 3 4 5 6 7 strongly agree
28. The security of being an accepted member of a group is very
important to
me.
strongly disagree 1 2 3 4 5 6 7 strongly agree
29. If my brother or sisters fails, I feel responsible.
strongly disagree 1 2 3 4 5 6 7 strongly agree

Note: Independence items are marked *. The rest are interdependent
items.
```

Appendix C (part of online survey)

Inglehart questions

```
There is a lot of talk these days about what this country's goals
should be in the next ten or fifteen years. Would you please say which
one of them you yourself consider most important in the long-run:
```

Maintaining the order of nation _____

Giving the people more say in important government decisions _____

Fighting rising prices _____

Protecting freedom of speech _____

Appendix D (part of online survey)

Alternate Grid/Group Questions

1. "People should sacrifice their own interests for sake
of the group"

10. "People should pursue their own interests as individuals"

1   2   3   4   5   6   7   8   9   10

1. "People should follow the rules of society"

10. "People should decide for themselves what to do"

1   2   3   4   5   6   7   8   9   10

Demographic Questions (part of online questions)

 - Are you female or male?

              Female/Male

 - What is your class standing at the university?

              Freshman/Sophomore/Junior/Senior/Masters's/PhD JD MD/ Faculty Staff

- In which year you were born?   ……………………………………

Please provide answer for the following questions. Leave it blank if you don't want to answer these questions.

Your current citizenship? If you have dual citizenship, please name both countries.

In which country were you born?

With what country do you identify yourself most strongly?

With which country do you identify yourself with the most strongly? If you cannot single out one, please specify each country with which you identify most strongly.

Which language is your first language (the one you became fluent in first)?

What language is the one you currently speak most frequently in everyday conversation?

What is your religion? Where relevant, please list both your religion and your denomination or organization within the religion. If you have no religion, please specify as well. Add additional explanation as you feel this necessary.
Leave it blank if you don't want to answer this question.

Ethnic groups refer to particular peoples, tribes, or castes tied together by common characteristics such as race, religion, language, and/or region of origin. **Do you identify with any particular ethnic group or groups within your nation or country? If so, please list the group or groups.** Add additional explanation as you feel this necessary. Leave it blank if you don't want to answer this question.

Your name. (Your name is needed to confirm you have completed the survey in order to admit you into the experiment and pay you in the lab for your participation. Your name will not be publicly associated with the responses that you give on this survey, which will remain confidential.)

Your email address: ………………….

Cultural Values and Behavior in Two-Person Games

Sun-Ki Chai, Dolgosuren Dorj, Min Sun Kim, Ming Liu, and Katerina Sherstyuk

University of Hawaii at Manoa

ESA, Tucson November 12-14, 2009

Motivation and Objectives

- Culture plays a significant role in people's economic behavior

- Broad objective: use economic experiments to study cultural differences and ways to improve cooperation and prevent violence within and among cultures

- This paper: study the role of culture in people's behavior in economically-relevant games:

  - dictator, ultimatum bargaining, and trust games

- Other studies focus mostly on cultural differences between communities (e.g., countries or ethnic group)

- We focus on universal dimensions of culture

- <u>Research question</u>: how individual's cultural attributes affect their pro-social behavior?

- <u>Methodology</u>: measure subject's cultural attributes using attitudinal survey and correlate them with their behavior in experiments.

- <u>Finding</u>: Cultural factors may be a good predictor of economic behavior

Contribution

- Provide methodology to measure cultural attributes that embed individual choices

- Use general cultural dimensions to predict behavior under various conditions and make comparison

- Broad implication: improve cooperation and prevent conflict within and among cultures

Universal dimensions of Culture: grid/group concept

- **Grid/group theory in Cult./Soc. Anthropology and Political Science: Douglas 1970, 1978; Douglas and Wildavsky 1982; Wildavsky et al. 1990. Adapted for choice-theoretic models in Chai and Wildavsky 1993; Chai and Swedlow 1998**

Grid- **extent to which an individual's actions are governed by externally defined social norms** (~ strong reciprocity)

Group- **extent to which an individual's sense of welfare is merged with that of others** (~ altruism)

Previous studies that use survey or ring test

Attitudinal survey:

- Glaeser et al. 2000, Ahn et al. 2003, Ashraf et al. 2003, Danielson and Holm 2003, Gächter et al. 2004 GSS trust questions predict trustworthy behavior than trusting behavior.

- Fehr et. al 2002 (GSS). Direct questions about trust in strangers and questions about past trusting behavior are good predictors

- Capra et al.,2007 (WVS/GSS). attitudinal questions may predict trusting actions depending whether the altruism is controlled for

- Ma et al.,2002 (PMP by Wong 1998). altruism has weak positive effect on contributions

Ring test (social value orientation):

- Liebrand,W.B.G., 1984, Offerman et al. 1996, Sonnemans 1998, Van Dijk et al., 2002. only altruism (cooperation) is measured, no reciprocity

Method and procedures

Pre-test survey:

- Includes selected 22 questions by Chai (2006) from World Values Survey (WVS) to measure subject's cultural characteristics along grid (strong reciprocity) and group (altruism).
- Individualism/collectivism self-construal scale with 29 questions by Leung & Kim (1997).
- Materialism questions by Inglehart (1971).
- Demographic and identity questions

Laboratory experiments involving 220 subjects in two-person 5 games: dictator, ultimatum, trust.

Survey instrument

Examples of questions for grid/group measure:

☐ Please say, for each of the following, how important it is in your life...FAMILY….FRIENDS…RELIGION

☐ With which of these two statements do you tend to agree? 1. Regardless of what the qualities and faults of one's parents are, one must always love and respect them 2. One does not have the duty to respect and love parents who have not earned it by their behavior and attitudes

☐ Do you agree or disagree with the following statements? When jobs are scarce, men should have more right to a job than women

Examples of individualism/collectivism measure:

☐ My happiness depends on the happiness of those in my group.

☐ I don't change my opinions in conformity with those of the majority.

Experimental Design

■ After completing the survey, subjects participated in Dictator (DG), Ultimatum Bargaining (UB), and Trust games (TG)

Dictator Game (DG): player 1 chooses the split of $10, player 2 has to accept

Non-convex UB: player 1 chooses the split of $10, player 2 accepts or rejects

Convex UB: player 1 chooses the percentage split, player 2 chooses the amount of money to divide (between $0 and $10 conditional on the split)

Non-convex TG: Player 1 chooses to send or not $6, player 2 chooses how much of the sent amount (which is doubled) to return

Convex TB: Player 1 chooses how much of $6 to send, player 2 chooses how much of the sent amount (which is doubled) to return

Experimental design

- Strategy method
- No feedback between decisions
- Perfect stranger matching
- Two decisions randomly chosen as a paid task
- Two-role (subjects played both roles: proposer and responder)
- Computerized sessions implemented in Z-tree (Fischbacher, 2007)

Dictator game

Result 1:

- **Individualistic (self-interested) type donates less.** Independence index was negatively correlated with the donations (p=0.003). Grid/group scores were not significant.

Figure 2. Offers in dictator game, two-role treatment, N=100
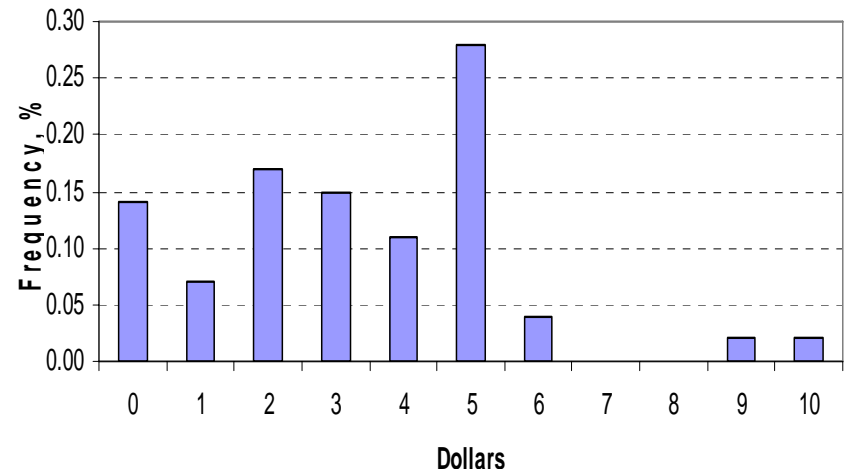
Mean was 3.32, st.dev. 2.22 Modal offers were at 50 percent of endowment.

Non-convex Ultimatum game,
censored tobit

Result 2:

- Altruists give more Group scores positively affect the offers (p=0.018) Altruists accept low offers and negatively correlated with an acceptable amount (p=0.019).

- Reciprocal subject's minimum acceptable amount is higher grid scores are positively correlated with the acceptable amount (p=0.043).

Non-convex Ultimatum game by typology

Wilcoxon ranks sum test

Result 2 continues

Mean Offer by typology
Non-convex Ultimatum game, two-roles

Bar chart: Average offer from $10, %
- Low-grid, High-group: 51
- Low-grid, Low-group: 42
- High-grid (HL, HH): 42

p=0.0375, two-sided (between Low-grid High-group and Low-grid Low-group)
p=0.0526, two-sided (between Low-grid High-group and High-grid)

Cut-point for grid=0.41, group=0.50   HL means high-grid, low-group
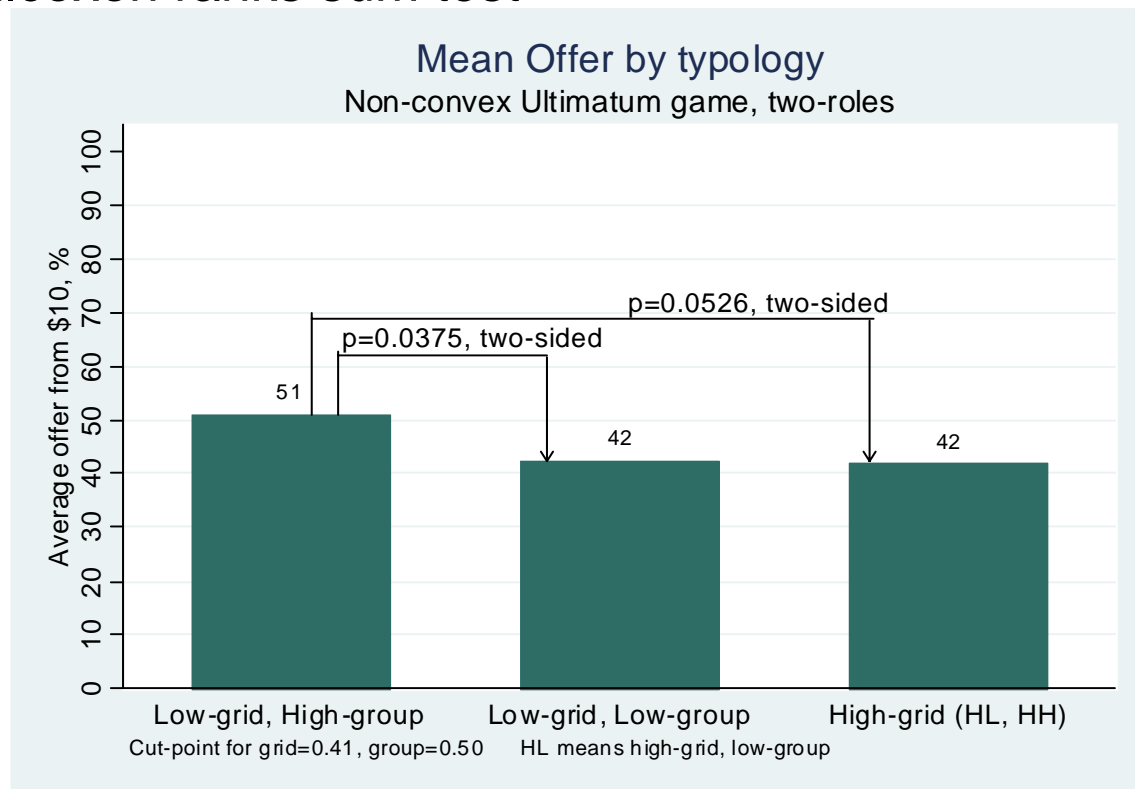
Mean 44.8%, st.dev. 21.2

Offers were higher for high-groupness individuals (altruists)

Convex Ultimatum game
Result 3:

■ Reciprocal subjects divide less dollars as responders Grid scores were negatively correlated with the amount to divide (p=0.004, censored tobit).

Mean Amount to Divide by Typology
Convex Ultimatum game, two-roles

p=0.01 14, two-sided

Y-axis: Average amount to divide, from $10 (0 to 10)

Bars:
- Low-grid, high-group: 8
- Low-grid, Low-group: 9
- High-grid (HL, HH): 7

Cut-point for grid=0.41, group=0.50   HL means high-grid, low-group
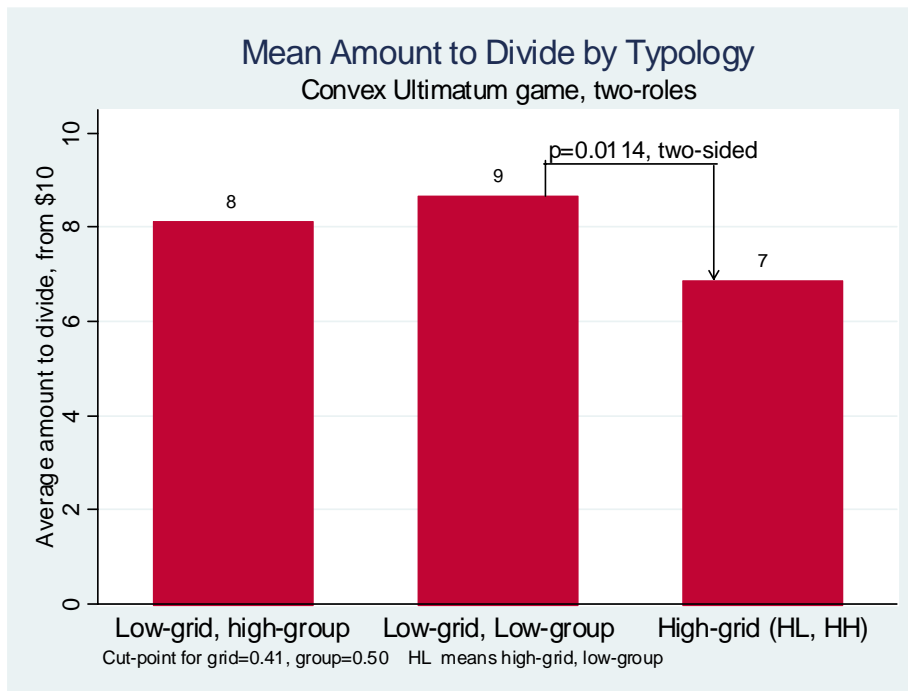
Distribution of types:

31 % were LH (altruist)

21 % were LL (self-oriented)
48% were High-grid (reciprocal)

(HH-23, HL-25)

 Mean was **7.64,** st.dev.**3.35**

Non-convex Trust game

censored tobit

Result 4:

- **Altruists trust more** Group scores were positively correlated with the trust (p=0.06). **Older people, U.S. citizens trust more** Age (altruistic reason) and U.S. citizenship (institutional trust) have also positive effect on trusting action (p<0.05).

Non-convex Trust game

Result 4 continues

Wilcoxon ranks sum test

59 % trusted all $6

Altruists (high-groupness) and Reciprocal (high-gridness) individuals trust more than Selfish (low-groupness, low-gridness) types

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Convex Trust game

Result 5:

- **Reciprocal individuals sent back less** Grid scores were negatively correlated with the amount sent back to trustor (Pearson correlation coefficient=-0.2394, p=0.0247).

- **Older subjects trust more** Age has positive effect on trusting behavior (censored tobit, p=0.007).

Convex Trust games

Wilcoxon ranks sum test

Percent of trust by Typology
Convex Trust game, two-roles
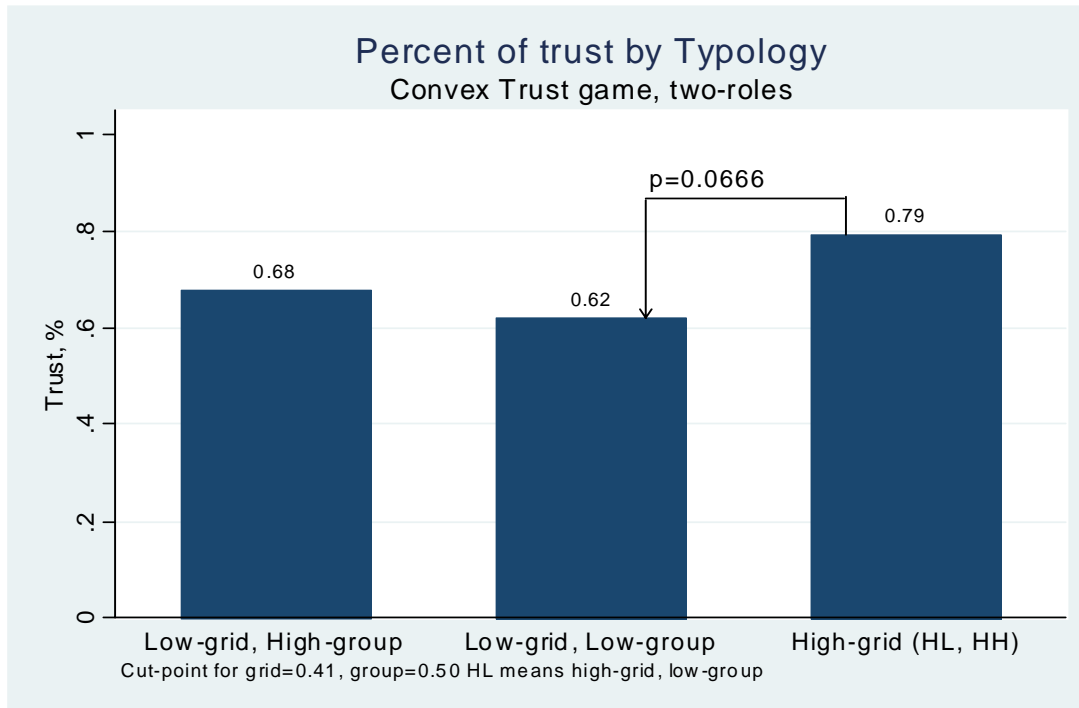
78% sent $1-$6

Reciprocal (high-gridness) individuals trust more than Selfish (low-groupness, low-gridness) types

Results

- Effects of cultural variables (Grid and Group) on behavior in games:
- **Two-role treatment:**
    - High-group (altruistic) individuals offer more percentage in both convex and standard ultimatum games ($p<0.05$), accept lower offer ($p<0.05$), trust more in the binary trust game ($p<0.1$ level).
    - High-grid (reciprocal) individuals accept higher offers ($p<0.05$) in non-convex bargaining , divide less dollars in the convex bargaining game ($p<0.05$), trust in both trust games ($p<0.1$).
    - Low-grid-Low-group (self-centered) types divide more dollars than high-grid individuals in the convex UG game, as punishing the proposer is costly ($p<0.05$).

Individualism/collectivism measure

censored tobit

- **Collectivist type trust more** Interdependence index was positively correlated with the trusting action in both versions of trust game (p=0.024, p=0.076).

- **Individualistic type donates less** Independence index was negatively correlated with the donations (p=0.003) **and divides more dollars since doesn't want bear cost of punishing others** and was positively correlated with the designator's decision (p=0.052).

Summary

- The group (altruism) and grid (strong reciprocity) attributes are good predictors of behavior in ultimatum games and VCM

- Individualism/collectivism measures are good predictors in dictator and trust games

- Overall cultural values can be a good predictor of behavior

- This suggests an avenue for research at the intersection of sociology, social anthropology and economics

Cultural values and behavior in dictator, ultimatum bargaining, and trust games

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University of Hawaii at Manoa

ESA -- Melbourne 2010

Motivation and Objectives

- **Culture plays a significant role in people's economic behavior**

- **Broad objective: use economic experiments to study cultural differences and ways to improve cooperation and prevent violence within and among cultures**

- **This paper: study the role of culture in people's behavior in economicaly-relevant games:**

  - **dictator, ultimatum bargaining, and trust games**

- **Other studies focus mostly on cultural differences between communities (e.g., countries or ethnic group)**

- **We focus on universal dimensions of culture**

Universal Dimensions of Culture: Grid-Group Framework

The framework is widely used in Cult./Soc. Anthropology and Political Science: Douglas 1970, 1978; Douglas and Wildavsky 1982; Wildavsky et al. 1990. Adapted for choice-theoretic models in Chai and Wildavsky 1993; Chai and Swedlow 1998

- **Grid:** extent to which an individual's actions are governed by externally defined social norms **(~ strong reciprocity)**

- **Group:** extent to which an individual's sense of welfare is merged with that of others **(~ altruism)**

Both Grid and Group can be defined as transformation on utilities, and their effect on social preferences can be seen as depending on the extent to which an individual identifies as a member of the same group as those with whom she/he is interacting.

Using the Grid-Group Framework

- ❑ **Research question:**
  - ■ **How do people's Grid and Group cultural attributes affect their social behavior?**
- ❑ **Methodology:**
  - ■ **measure individual grid and group scores using a survey instrument, then correlate them with behavior in economic games**
- ❑ **Findings (in progress):**
  - ■ **high group (altruistic) people offer more in ultimatum bargaining games, and trust more in trust games**
  - ■ **High grid (strong reciprocity) people return more if trusted**

Methodology: Survey instrument

- **We measure cultural values (Grid and Group) through attitudinal questions drawn from the World Values Survey**

- **11 questions to measure Grid scores, 11 questions to measure Group scores (2-point to 10-point scales)**

- **Examples of questions:**

  - *Please say, for each of the following, how important it is in your life...FAMILY….FRIENDS…RELIGION*

  - *[1] The government should take more responsibility to ensure that everyone is provided for; or [10] People should take more responsibility to provide for themselves*

  - *Do you think that a woman has to have children in order to be fulfilled or is this not necessary? [Needs children] or [Not necessary]*

Experimental Design

- **After completing the survey, subjects participated in Dictator (DG), Ultimatum Bargaining (UB), and Trust games (TG)**

  Dictator Game (DG): player 1 chooses the split of $10, player 2 has to accept

  Non-convex UB: player 1 chooses the split of $10, player 2 accepts or rejects

  Convex UB: player 1 chooses the percentage split, player 2 chooses the amount of money to divide (between $0 and $10 conditional on the split)

  Non-convex TG: Player 1 chooses to send or not $6, player 2 chooses how much of the sent amount (which is doubled) to return

  Convex TB: Player 1 chooses how much of $6 to send, player 2 chooses how much of the sent amount (which is doubled) to return

Experimental Design continued

- **Both One-role and Two-role designs**
- **Stranger design: each participant is rematched with a different person for every decision**
- **Strategy method used in all games**
- **No feedback between decisions**
- **One or two decisions are randomly chosen as paid decisions at the end**

- **Computerized sessions, implemented in z-tree**

- **68 subjects in 5 sessions in the one-role design (34 subjects in each role), 64 subjects in 4 sessions in the two-role design**

Experimental Results overview

- **Overall statistics by game – same as usual**
- **Differences between one-role and two-role designs**
- **Correlations of cultural attitudes (Grid and Group) with behavior in games**
- **Extra: Independence and Interdependence scales and their correlation with behavior**

Experimental Results- 1

- **Overall statistics by each game: standard results**
- **Differences between 1-role and 2-role are small, hence focus on 2-role data from now on**

	1-role		2-role		p-value:
	mean	stddv	mean	stddv	1-role vs 2-role
Dictator game:					
offer, $	4.26	2.95	3.23	1.93	**0.0198**
Ultimatum bargaining					
offer, $	5.09	2.05	4.47	1.85	**0.0661**
min acceptable, $	2.56	1.94	2.44	2.08	0.3898
Trust non-convex					
% subjects who trust	0.55		0.58		0.2267
share who returned if trus	0.4		0.35		0.1892

Experimental Results- 2

□ **Effects of cultural variables (Grid and Group) on behavior in games (preliminary findings):**

- **High-group (altruistic)** individuals offer more percentage in both convex and standard ultimatum games ($p<0.05$), trust more in the binary trust game ($p<0.1$ level), return more in both non-convex ($p<0.05$) and convex versions ($p<0.1$) of the trust game.

- **High-grid (reciprocal)** individuals trust and return more in the trust games

- **Low-grid-Low-group** types divide more dollars than high-grid individuals in the convex UG game when proposer keeps more than 50% for themselves, as punishing the proposer is costly

Difference between cultural types (two-role treatment)

mean/ st.dev.	LH High- groupness	LL individualist	HH, HL high- gridness	p-value	p-value	p-value
					Wilcoxon ranks sum test	
Grid	0.26	0.33	0.55	Ho:	LH=	LL=
Group	0.61	0.41	0.5	LH=LL	High-grid	High-grid
Ultimatum bargaining:						
Offer, $	4.76	3.73	4.53	0.0291	0.1212	0.9339
	1.73	1.42	2.03	>		
Div. Rule, %	40.1	27.36	36.91	0.0196	0.2430	0.1683
	16.8	17.22	19.19	>		
Trust game:						
Avg. send, $	3.47	1.33	4.25	0.0806	0.4081	0.0164
	3.04	2.65	2.79	>		<
Return, $	4.74	2.67	4.54	0.0394	0.6081	0.0431
	2.42	3.5	2.11	>		<
Conv.Trust, $	2.53	1.22	3.5	0.3090	0.3283	0.0431
	2.5	1.72	2.23			<
Return, $	2.63	0.56	1.5	0.0554	0.3967	0.0530
	2.5	1.33	1.96	>		<

Experimental Results- 3

- **<u>Overall</u>, the effects of Culture Variables (Grid/Group) on behavior are in the expected directions but are not always significant**

- **<u>Other demographic variables</u> are also important: *Male*, people with *higher education* and *older* people contribute less. When we controll for these variables, the effects of Grid/Group are more pronounced**

Extra: Independence and Interdependence scales

In addition to Grid/Group, we also included survey questions to measure <u>Independent and Interdependent Self-Construal Scales</u> (Leung and Kim 1997) to determine participants' cultural identities

Examples of questions:

- *I should be judged on my own merit*
- *I feel uncomfortable disagreeing with my group*
- *My personal identity, independent of others, is very important to me*
- *When with my group, I watch my words so I won't offend anyone*
- *If my brother or sisters fails, I feel responsible*

Findings on Independence and Interdependence scales

Findings:

- ☐ Independence is negatively correlated with giving in dictator game, positively correlated with decision on the total amount of money to divide in Convex Ultimatum Game

- ☐ Interdependence is positively correlated with sending (more) money in trust games

- ☐ Also, interdependence is positively correlated with the grid score (coeff= 0.3251, p=0.0093)

Other observations: methodology

- **Some differences in behavior between one-role and two-role designs, irrespective of cultural attributes:**

  - **One-role => more other-regarding behavior**

- **Features of experimental design:** *the strategy method, no feedback between decisions, not all decisions are paid,* **make the setting more abstract and harder to relate to for the subjects; may affect the results**

Conclusions (Preliminary)

- **Cultural factors (as measured by Grid/Group and Independence/Interdependence scales) may be a good predictor of economic behavior**

- **As predicted, Group attribute corresponds to altruism and Grid attribute represents strong reciprocity (willingness to follow norms and punish those who do not)**

- **This suggests an avenue for research at the intersection of sociology, social anthropology and economics**

Cultural Dimensions and Grid-Group Theory: From Classification to Process

Abstract

This article intends to outline the Grid/Group framework to demonstrate how a society deals with differences in power and hierarchy and with uncertainty and risk. We examine the potential advantages of this alternative in explaining preference formation with a series of comparisons of the relative strengths and weaknesses of grid-group theory and the conventional cultural dimensions. It is demonstrated how one conceptualization of culture, grid-group theory, overcomes aspects of some difficulties of other cultural dimensions and contributes to explaining institutional form and cultural change. While lack of empirical comparison data make our results tentative, we conclude that the Grid-Group framework retains the advantage of parsimony as the single most powerful predictor of culture change across a range of social and political issues. Grid-group theory allows us to unpack distinct social logics that are conflated in traditional unidimensional models by reconceptualizing culture in a more powerful and useful form. These logics not only tell us more about the bases for persons' attitudes, they offer an explanation for the shifting structure of political conflicts and coalitions. Thus grid-group theory opens up into a diversity of selves who construct a variety of interests in the service of different ways of life (or cultures).

Cultural Dimensions and Grid-Group Theory: From Classification to Process

In social sciences, the term "culture" refers to the shared ways and thinking that grow out of group experience and are passed from one generation to the next (Broom et al. 1981). Specifically, it refers to the deeper level of basic assumptions and beliefs that define in a basic taken-for-granted fashion a group's view of itself and its environment. These assumptions and beliefs are learned responses to the group's problems of survival in its external environment and its problems of internal integration (Schein 1985). What solutions and remedies are acceptable in a given problem-situation depends to a considerable extent on cultural values.

Harry Eckstein (1997) claimed that three postulates apply to culture as orientations: oriented action -- that cultural orientations are economizing functions that facilitate predictions; the postulate of orientational variability -- that orientations cannot be inferred directly from situations and context; and socialization -- that orientations are imparted by previously socialized carriers of culture. Once the concept of culture is understood in the way of orientations, then 'anything else about cultural *theories* [can] be properly understood' (Eckstein 1996, 472). Eckstein pondered whether a deeper cultural pattern exists by which observed cultural orientations can be described and explained; he wondered whether, some time in the future, one may have a scheme of cultural patterns 'analogous to the periodic table' (1997,29). Eckstein professed that grid-group theory's four cultures of hierarchy, egalitarianism, individualism and fatalism seem to be 'especially promising constructions for a cultural typology'. These types may be used to characterize both general political cultures as well as individual orientations. 'Most important, each may constitute a coherent "orientational system" ', the combination of which 'may in fact exhaust all possible such systems of political orientations' (1997,31).

A limited set of cultural biases -- or 'social logics' (Coughlin & Lockhart 1998), 'superorientations' (Eckstein 1997) or 'master preferences' (Wildavsky 1994) -- is plausible only if they are to have an economizing function. The central feature of grid-group theory's cultural biases, which is the focus of this article, is found in their varying notions of the concept of equality. These are as follows: egalitarianism -- equality of result/condition; individualism -- equality of opportunity; hierarchy -- procedural equality; and fatalism -- 'no equality on this earth' (Thompson 1992). Each notion of equality is used to justify an issue (i.e. position, goal or policy). These four justifications, grid-group theory argues, are universal, whereas the number of issues available to them is practically unlimited.

The primary purpose of this paper is to introduce the Grid/Group framework (which has subsequently become known as "Cultural Theory" (CT)), in comparison to the conventional cultural dimensions for understanding the configurations of culture (ideologies, values, and beliefs). This article intends to outline the Grid/Group framework to demonstrate not only *why* culture matters, but also *how* it can be analysed. We examine the potential advantages of this alternative in explaining preference formation with a series of comparisons of the relative strengths and weaknesses of grid-group theory and the conventional cultural dimensions. It is demonstrated how one conceptualization of culture, grid-group theory, overcomes aspects of some difficulties of other cultural dimensions and contributes to explaining institutional form and cultural change.

Defining Culture and Studying Cultural Differences

Culture differs from one society to another. How do we differentiate between them? A classic distinction is between active and passive societies. Active societies seek opportunities in

their environment for improving their conditions and display a desire for attainment and to be in charge. Passive societies, on the contrary, seek to maintain their status quo and display a tendency to be under the control of natural processes, of social waves and developments, or of active others (Etzioni 1968). In other words, societies differ in they way they deal with uncertainties: do they perceive them as opportunities or as threats? It is self-evident that seeking new opportunities requires fundamentally different sets of information than the maintenance of a status quo.

In an attempt to comprehend the nature of culture and cultural differences, we need to engage in disciplinary introspection. One dimension of this activity will be to relate the evolution of cultural research which have influenced the social sciences over the course of time.

Two-Culture Comparisons

Researchers from cross-cultural communication, cross-cultural psychology, linguistics and other related fields focused on differences in behavioral and conversational strategy choices across cultures. Comparing findings in different cultures is frequently used to examine the impact of culture on communication behavior. Although useful in evaluating whether cross-cultural differences exist, it is far less helpful in explaining why culture has an effect. For example, if one found with this method that people in the U.S. used more dominating conflict styles than people from Korea, there would be little direct evidence that the different results in the two cultures were attributable to cultural values or independent self-construal. Perhaps the most important criticism of much of this research is that explanations for cross-cultural differences are frequently post hoc, and there is no direct assessment of any intervening variables that are presumed to affect the dependent variable. There is in general within this literature a

lack of theoretical analysis underlying different behavioral practices and the relevance of cultural

conditioning to that process.

Typically, such investigations have attempted to describe various communicative

strategies or classes of behavioral tactics that people might use across cultures in the pursuit of

some goals. While this research provides an important and rich descriptive base, two

fundamental problems stand out: (1) understanding, and (2) prediction, of behavioral choices.

First, why are certain types of behavioral strategies preferred by a cultural group?

Typically, studies do not deal with the theoretical reason why a particular alternative is chosen.

A few researchers attempt to explore the origins of preferred strategies by relying on norms,

rules and conventions. For instance, some researchers in communication and sociology have

generated a corpus of rules (e.g., Cronen, Pearce & Tomm, 1985; Pearce & Cronen, 1980).

Norms and rules, being specific to particular social situations, have a severely limited

explanatory role in comparative research, since the findings and bits of information on the choice

of strategies frequently appear as isolated entities without connection to other situations. The

appeal to certain norms and rules, therefore, runs the risk of not being applicable to other

situations. Jacobs (1985) argues that a conventional rule-based logic cannot capture: (a) the

ways in which actors infer beyond the information given to achieve coherence; and, (b) organize

communication functionally.

The second problem in most cross-cultural studies in behavioral styles relates to the

predictability of communicative strategy choices. Expressing interaction patterns declaratively

restricts their predictability in other situations. We can imagine such scenarios as 'what to say

when a policeman pulls you over for speeding in Saudi Arabia', or 'how to refuse a request from

a best friend in Japan'. Knowledge to handle such situations would be readily available if the interaction situations described were the ones frequently encountered by an individual. However, not all situations occur in standardized packages (i.e., script-like), and, of course, we cannot describe every possible strategy choice so as to account for every possible interaction goal across cultures.

Understanding others' intentions and predicting others' strategy choices should be the critical endeavors in cross-cultural strategic competence. In order to understand we must predict, and in order to predict there must be background knowledge of why specific strategy choices are made across cultures. Thus, researchers recognized that there is a need to go beyond the descriptive portrayal of different people toward discovering the underlying reasons for behavior that may be shared to some extent among them.

Cultural Dimensions

Going beyond descriptive, binary contrast, the dimensional strategy aims at discovering basic features that must be clearly defined in any culture, and then at characterizing cultures according to the degree of such features. The whole culture is the usual unit of comparison, so this approach necessarily assumes that cultures can be more or less readily identified and delineated into distinct units. Most theories using dimensions, which assume continuous variation, posit that the dimension can be used with validity to assess all cultures (Fiske et al., 1998).

By far the most extensive body of dimensional research assesses values, using rating scales. The goals of this paradigm are to characterize cultures (usually defined on the level of

nations) and the dimensions that differentiate them. The basic assumptions of this approach are that these same samples represent the cultures of nation; that valid comparisons can be made across samples among ratings of items; the means of individual response reflect collective values.

In pioneering research, Hofstede (1980) administered a questionnaire on work-related values to 116,000 service and marketing managers of IBM in forth countries. Hofstede computed mean scores for each value statement in each of the forty countries and performed a factor analysis on these means by treating each country as a unit of analysis. From this analysis he identified four basic cultural dimensions--power distance, individualism (versus collectivism), masculinity (versus femininity), and uncertainty avoidance. Power distance implies the degree to which unequal power distribution is coail institutions and practices is accepted or, conversely, egalitarianism is endorsed. The masculinity dimension refers to the extent to which they value "masculine" values such as achievement and material success, or "feminine" values such as caring and interpersonal harmony. Uncertainty avoidance taps the degree to which a culture tolerates uncertainty and ambiguity. "At last, a cross-cultural navigator had an empirically charted map to guide and inform our journey" (Bond, 1994, p. 68).

Hofstede identified "individualism-collectivism" as one of four key psychological dimensions along which nations differ reliably (the other three being power distance, uncertainty avoidance, and masculinity-femininity). Hofstede defined individualism as a tendency to place one's own needs above the needs of one's in-group and collectivism as a tendency to place the needs of one's in-group above one's own needs. Since the advent of cultural psychology, those definitions of individualism and collectivism as mutually exclusive have gone largly unchallenged.

In recent years, two more multinational surveys have sought to elucidate the significant value dimensions on which cultures vary (Schwartz & Bilsky, 1987; Trompenarrs, 1993); each has identified a dimension closely related to individualism-collectivism. Subsequent work in this area has focused primarily on the dimension of individualism (versus collectivism). Individualism-collectivism has been considered "the single most important dimension of cultural difference in social behavior" (Triandis, 1988). Its popularity for cross-cultural communication derives from its use as a culture-level explanation for observed cultural differences in behavior.

The culture-level contrast between individualism and collectivism has exerted a magnetic pull on cross-cultural researchers. Researchers frequently designated culture or countries as "collectivist" or "individualist." When challenged, researchers defend their labelling by pointing to Hofstede's (1980) map. This mapping is derived, however, from individual value responses, mechanically averaged to yield country scores. These country scores were then factor analyzed to yield country-level factors. Hofstede's (1980) other three dimensions have been relatively ignored. Individualism is typically analyzed as the critical element of Western society (Guisinger & Blatt, 1994; Markus & Kitayama, 1998). The concept of individualism and collectivism has been described by Triandis et al. (1986) as perhaps the most important dimension of cultural differences in social behavior across the diverse cultures of the world. Numerous cross-cultural studies (e.g., Hui, 1984; Hui & Triandis, 1986; Hofstede, 1979; Hofstede & Bond, 1984; Bond & Forgas, 1984) have provided empirical evidence supporting the usefulness of the individualism and collectivism dimension as a way of categorizing cultures. Hui (1984) and Hui & Triandis (1986), after surveying cross-cultural anthropologists and psychologists from all parts of the world, conclude that the dimension of individualism and

collectivism can be used as a powerful theoretical construct to explain the relational differences and similarities between cultures.

In dealing with the constructs of individualism and collectivism, Triandis, Bontempo, Villareal, Asai & Lucca (1988) posit that "the emphasis is usually on people more than task in collectivist cultures, and the reverse happens in individualist cultures". Specifically, Triandis et al. (1988) have defined collectivism as having a great emphasis on: (a) the views, needs, and goals of the in-group rather than of oneself; (b) great readiness to cooperate with in-group members, and (c) intense emotional attachment to the in-group. Individualism is reflected in (a) self-reliance, (b) low concern for in-groups, and (c) distance from in-groups. In other words, individualism is defined as the tendency to be more concerned about one's behavior for one's own needs, interests, and goals, whereas collectivism refers to the tendency to be more concerned about the consequences of one's behavior for in-group members, and to be more willing to sacrifice personal interests for the attainment of collective interests and harmony (see Leung, 1987; Triandis et al., 1986; Hui, 1984).

Individualism and collectivism have been recognized under various other names as addressing relational aspects of cultural groups: Miller (1984) distinguishes between individualistic (stressing autonomy, self-aggrandizement, and the sense of personal inviolability apart from society) and sociocentric (holding the person to be fundamentally related to others, stressing empathy and the readiness to adjust one's behavior to the situation or group) concepts of the person. Hsu (1981) differentiates individual-centered life (emphasis is put on the predilections of the individual) and situation-centered life (emphasis is on an individual's appropriate place and behavior in situation-centered life). Yang (1981) has articulated a similar

position: <u>social orientation</u> (a tendency for people to act in accordance with external expectations or social norms) versus <u>individual orientation</u> (focus on internal wishes or personal interest). Parsons, Shils & Olds (1951) similarly distinguish between <u>self-orientation</u> (the permissibility of an actor's pursuing any interests private to him/herself) and <u>collectivity-orientation</u> (the actor's obligation to pursue the common interests of the collectivity). Similar distinctions have been proposed to study individual differences: <u>allocentric</u> versus <u>idiocentric</u> orientation (Triandis, Leung, Villareal & Clark, 1985); <u>social orientation</u> versus <u>goal orientation</u> (Frese, Stewart & Hannover, 1987).

Individualism is supposed to be found in affluent societies (Hofstede, 1980), especially if there are several normative systems (as happens at the intersection of many cultures or in some urban [Freeman, submitted], multicultural, cosmopolitan societies), in which case the individual has to decide whether to act according to one or another normative system. It is also high among the upper classes and professionals in any society (Freeman, submitted; Kohn, 1969; Marshall, 1997), among those who migrated (Gerganov, Dilova, Petkova, & Paspalanova, 1996) or were socially mobile, and among those who have been most exposed to mass media from the United States (McBride, 1998). Content analyses of soap operas made in the United States show that the major themes are individualist, and the focus is rarely on collectivist themes.

Collectivism is found in minority groups in the United States (Gainesetal., 1997), in societies that are relatively homogeneous (so that in-group norms can be accepted widely), where population density and job interdependence are high (because they require the development of and adherence to many rules of behavior), in agricultural societies, among older members of a society (Noricks et al., 19B7), among those who are members of large families (because it is not

possible for every member to do his or her own thing), and in groups that are quite religious (Triandis & Singelis, 1998).

Although the utility of the constructs is indisputable, there is still the tendency to conceive of individualism and collectivism in pure dichotomies in many contexts. Many researchers studying individualism-collectivism (e.g., Bond, 1991; Chinese Culture Connection, 1987; Hofstede, 1980) assume that cultures have one tendency with respect to the individualism-collecitivism. Other researchers (e.g., Gudykunst & Ting-Toomey, 1988; Kim et al., 1996; Miyanaga, 1991) assume that there can be both individualistic and collectivistic tendencies in the same culture, but that one predominates.

Despite the intuitive appeal of dichotomies such as individualism-collectivism, at least one other pair of personality constructs defined as dichotomous by Hofstede (1980), namely masculinity-femininity, already had been redefined conceptually and empirically (Bem, 1974; Spence, Helmreich, & Stapp, 1974) as orthogonal dimensions in the mid-1970s. Perhaps it is not surprising that some authors have begun to call for a redefinition of individualism and collectivism as orthogonal constructs (e.g., Bontempo, 1993; Kagitcibasi, 1996a; Kim et al., 1996; Oyserman, 1993).Although impressive in both the breath of cultures covered and the general convergence of the findings by different research groups, the dimensional approach confront some methodological and conceptual problems. When subjective values are examined by questionnaire, the overall means are often aligned in the predicted direction(with, for example, U.S. sample being more individualist and less collectivt than, say, Japanese sample). However, there is considerable overlap between the distributions of responses in any two cultures. Hence subjective endorsement of values is only a rough proxy for the collective practices and meanings

corresponding to such values, and it may not adequately represent the magnitude or nature of cultural differences.

Cross-cultural researchers often use culture-level explanations for observed differences in behavior. This is problematic, because culture is too diffuse a concept and therefore a poor independent variable (Segall, 1983) unless its links with behavior are specified in terms of mediating variables (see Kagitcibasi, 1994). In the absence of refined intervening variables, "what" in culture "causes" behavior is often not clear. Explanations resorting to individualism and collectivism appear to be particularly prone to this weakness, because the construct is being used so readily, almost synonymously with cultural differences in general. Yet at times it is not clear whether individualism and collectivism is the relevant antecendent variable for the observed differences in behavior (Kagitcibasi, 1994; Singelis & Brown, 1995).

Researchers have operationalized one's cultural identity primarily by using the dimension of individualism-collectivism (e.g., The United States as an individualistic culture, Taiwan as a collectivistic culture). This operationalization runs the risk of being too vague and general. What can be said of the individual within a particular culture? While conceptually one can "expect culture-level and individual-level value dimensions to be related" (Schwartz, in press), it is still an empirical question whether the culture-level description can be translated at an individual level. The analytic gap between culture and individual behavior can be bridged with the study of individual-level correlates of behavior associated with the cultural dimension. Given the theoretical significance of studying the relationship of one's behavioral patterns and culture, studying the cognitive correlates of individualism-collectivism is very important.

Limitations of Prior Cultural Dimensions

Notwithstanding its merits, prior cultural models including Hofstede's model have some weaknesses.

A Vacuum of Power and Interest

Much of prior cultural dimensions have failed to recognize, or perhaps more correctly, were reluctant to acknowledge the power interests and power practices involved. The "linguistic/cultural difference" perspective is merely a difference in describing things (e.g., reference, evaluation) between members of two cultures. But the social-action nature of communication is ignored. A vacuum of power and interest within communication is presumed (Shi-xu & Wilson, 2001).

For instance, in analyzing the very words of Hofstede in his second edition of Culture's Consequences (2001), Martin and Agneta (2007) focused on Hofstede's colonial discourse leading to sharp binary oppositions between a "developed and modern" side (mostly "Anglo-Germanic" countries) and a "traditional and backward" side (the rest). According to Fabian (1986), "the other is never simply given, never just found or encountered, but made" (p. 208). The description of Western people as "developed and modern" and non-Western people as traditional, irrational and prone to mysticism is a discursive construction based on colonial thinking (Martin & Agneta, 2007). Similarly, Moreno (1997) claimed that the modernist principle of inevitable progress and its culmination in Western culture -as the standard to measure the rest of the cultures- is the philosophical base for all those comparisons illustrating these dimensions. In the particular case of the individualist-collectivist dichotomy, needless to say, the individualistic standard tends to be more related to the "civilized" cultures and the collectivist standard tends to be related to the "primitive" ones. Martin and Agneta (2007) call to

open up for an alternative knowledge production which includes rather than excludes and criticizes the other.

There is increasing recognition of knowledge as a historical force in which Western culture as the culmination and the standard of judgment of other cultures. Through scientific discourse we are participating in society, we are producing social discourse permeated by ethics and relations of power because scientific discourse is only one kind of discourse among others (Moreno, 1997). We need to recognize, in our scientific activities that produce "knowledge" (e.g. in developing theories and applying methodologies), that there are power issues as well as inter-theoretical and extra-theoretical interests embedded in our thinking and reasoning.

Culture as Fixed and Stable Group

Though the construct of a dualism between Western and non-Western notions of the self as individuated and sociocentric respectively, is a useful heuristic, the constructs of the self are certainly more complex than that. Markus and Kitayama pointed out that the theories on the non-Western cultural sense of self are often simplified, declaring that people in non-Western societies merge their individuality with others within the society. They stated that "an interdependent view of self does not always result in a merging of self and other, nor does it imply that one must always be in the company of others to function effectively, or that people do not have a sense of themselves as agents who are the origins of their own actions" (Markus & Kitayama, date , p. 298). Thus the literature on culture and the self draws an oversimplified contrast between West and non-West.

We also want to note here that empirical research has demonstrated the co-existence of both independent and interdependent self-construals in individuals (Brewer & Gardner, 1996; Gudykunst et al., 1996; Kim, et al., 1996; Singelis & Brown, 1995). Furthermore, there is a growing awareness of the identity challenges and communication patterns in the life of the bicultural and multicultural person. Whether through immigration, sojourning, marriage, adoption, or birth, a wide range of people are actively carrying the frame of reference of two or more cultures (see Bennett, 1993). Thus, in discussing the two types of self-construals, for instance, we do not wish to stereotype or classify individuals. Rather, the descriptions illustrate two types of self-construals, in the extreme, that co-exist in each individual. The strength in the tendencies are, in part, enabled and developed according to cultural background.

Multicultural or multiethnic groups live in the same country, and cultural or subcultural diversity can be found within ethnic groups, and different ethnic groups can share elements of the same culture. These accelerated changes in the modern world compel us to take cognizance of the dynamic nature of individuals' cultural identity. With bicultural and multicultural processes occurring in which individuals are exposed and enculturated to more than one culture, the very notion of cultural boundaries within the bicultural or multicultural mind may be antiquated, irrelevant, nonsensical.

A contemporary view of self-culture relations suggests that this relationship is much more complex than previously thought, and certainly more complex than a generalized view of self that pits individual and group needs in opposition to each other. Research on cultural identity encourages psychological work that is sensitive to 'hybrid' identities. Such identities are shaped by migration, discrimination, poverty, and minority ethnic, racial and religious statuses. The

findings alert us to aspects of the 'other', marginalized cultural identities. Clearly, there is a need for more fine-grained analyses that capture the subtlety of particular outlooks and the heterogeneity and overlap that exists between and within different cultural communities. Increasing cultural connections, with subsequent hybridization and the emergence of a world system that implies an interpenetration of the global and the local, further amplify the complexity of "culture" (M.-S. Kim, 2002).

Cultural Biases as a Different Way of Life – The Grid-Group Framework

Theory of Cultural Change

Interest in cultural phenomena, and in work that takes a cultural perspective, is growing within social sciences. This developing framework no longer takes western culture as standard, or grounds itself in mainstream western psychology (Woollett *et al.,* 1994). Instead, it tries to address the specific characteristics of different aspects of culture. This work breaks with the notion of 'cultures' as the fixed properties of stable or homogeneous groups (Clifford and Marcus, 1986). It seeks to understand the complexity of identities and identifications as they cut across established cultural categories. Such work shifts concern with cultural differences from the margins to the centre.

An interest in culture seems to encourage psychological work that is sensitive to 'hybrid' identities. Such identities are shaped by migration, discrimination, poverty, and minority ethnic, racial and religious statuses. They appropriate elements of dominant western cultures, but they themselves also come to inflect those cultures, and in addition they retain and transform aspects of 'other', marginalised cultural identities.

Grid/Group is a typology of social environments created by anthropologist Mary Douglas (Douglas 1970), and has been adapted, modified and applied over the subsequent years to develop into a subject of it's own. According to Douglas, "The book was an attempt to develop Durkheim's programme for a comparative sociology of religion so that it could apply as well to Australian totemism as to modern industrial society" (Douglas, 1970, 1996).

Douglas argued that social structures differ along two principal axes: "grid" and "group." Grid refers to the degree to which individuals' choices are circumscribed by their position in society. Group refers to the degree of solidarity among members of the society. These dimensions were based on the work of the classic sociologist Emile Durkheim.

The grid/group concept was introduced to the risk analysis community in 1982 by a book Douglas wrote with political scientist Aaron Wildavsky, *Risk and Culture*. The scheme was elaborated by Wildavsky, Michael Thompson, and Richard Ellis in their 1990 book *Cultural Theory*. This typology has been very influential in the field of risk perception research. It proposes four major biases: Individualist, Egalitarian, Hierarchist, and Fatalist, plus a fifth asocial Autonomous perspective.

Douglas argues that two dimensions of sociality can adequately capture the variability of an individual's involvement in social life: group and grid. Group refers to the extent to which an individual is incorporated into bounded units. The greater the incorporation, the more individual choice is subject to group determination. Grid denotes the degree to which an individual's life is circumscribed by externally imposed prescriptions. The more binding and extensive the scope of the prescriptions, the less of life that is open to individual negotiation. These two dimensions (group and grid) together produce four different "ways of life" (summarized by Carver 2001):

Thompson et al. (1990) emphasize the dynamic character of these ways of life. Cultures are neither permanent nor singular. When conditions change, ways of life may change as well. Within one social group, different ways of life can be recognized and are in permanent dynamic imbalance; forming alliances though remaining competitors.

When a whole culture or society is pigeonholed in dichotomous categories such as masculine/feminine, active/passive, or loose/tight, subtle differences and qualitative nuances that may be more characteristic of these social entities are glossed over. Also, when cultures and individuals are presented in black-or-white terms, not only does this cloud our understanding of them, but it inevitably leads to our making good/bad comparisons (Kim, 2002).

The basic premise of Grid/Group is that cultural relativism can be transcended through the application of a universally applicable classification system. Competing moral systems, worldviews and ideologies are brought into the realm of comparative analysis by granting attention to different local conditions, and the ways in which groups are organised. Despite having its origin in social anthropology, the system is essentially deductive and rests on two axes.

The first, "group", is similar to the distinction between individualism and collectivism that exists within Hofstede (1980) and underpins much political science. It is intended to show the role of group pressure upon a person's ego, stemming mainly from moral compulsion and the degree of group integration. By transposing another axis on top of group pressure, (creating two individualistic and two communitarian cultures) provides the innovation behind the Grid/Group framework, and demonstrates it's value-added over simple dualism. "Grid", the second axis, refers to the constraints created by an ordered structure, or the regulation that is imposed upon the group members. It exists when explicit rules and orders determine social opportunities, and

their relative ranking within the group defines their status. Therefore the more that a member of a group feels bound by a collective decision, the higher they are on the "Group" dimension. The greater the degree to which the member follows imposed rules, the higher they are on the "Grid" distinction. This blend of "Group" vs. "Grid", of integration vs. regulation, of solidarity vs. constraint, provides the framework upon which a comparative Cultural Theory can be created.

The range of actual social practice is constrained because only four general ways--each admitting some variations--of responding to these questions are socially viable.(n4) Preferences for various patterns of social relations prompt supporting justifications or cultural biases and vice versa. Together, preferences and justifications form distinctive ways of life or cultures (see Figure 1).

Figure 1 shows the Group and Grid framework and posits extreme conceptual classifications of "high" or "low" for both, generating four logically distinct group cultures. Low Grid/Low Group is typically labelled as "individualist", demonstrating a low level of communal involvement, and a negative attitude toward restrictions on freedom of choice. Low Grid/High Group is the "egalitarian" or "sectarian" culture and combines a belief in low levels of social hierarchy with a high degree of solidarity. High Grid/High Group is "hierarchist", and will favour clearly defined parameters of action, and a commitment to the institutions that create them. High Grid/Low Group, the "isolate" or "fatalist", responds to instructions and directives, in isolation from a group identity.

According to Evans (2007), it is important to realise that the framework thus developed is universal and can therefore be applied across time and place. However this wide applicability comes at a cost; it is a lens to understand organisational culture, rather than a full description of

reality. For this reason there is no such thing as an "egalitarian organisation", merely

organisations that differ in the degree to which egalitarianism applies. Therefore we can't

categorise organisations in a simplistic fashion, labelling them neatly into one of four alternatives.

Indeed the unit of analysis needs to be carefully considered, because there's no clear definition

for what it should be. It's impossible to classify an individual as being "a hierarchist" etc for two

reasons. Firstly people will exhibit different characteristics depending on their environment, and

therefore one might act in a "hierarchical" manner when chairing a conference call, and an

"egalitarian" manner face-to-face. Secondly the concepts are sociological and therefore apply to

cultural contexts rather than personalities. However an entire corporation is too complex and

multi-faceted to be summed up as one convenient type, so what is an appropriate unit of analysis?

Although talking about individuals and corporations as a particular cultural type *can* be useful as

a proxy and indication of a deeper phenomenon, they are most applicable to the specific roles

that people play within a group (Evans, 2007).

Figure 1:

	High Grid /High Group	High Grid /Low Group	Low Grid /High Group	Low Grid /Low Group
categories	Hierarchist	Fatalist	Egaliarian	Individualist
goal	order	survival	justice	liberty

Individualist

Individualists experience low grid and low group. That is, their choices are unconstrained by society and they lack close ties to other people. They value individual initiative in the marketplace, and fear threats like war that would hamper free exchange. The individualist view of nature is described as cornucopian or resilient. Individualists embrace trial-and-error, as they have confidence that the system will fix itself in the end. For instance, individualists perceive a bountiful and resilient natural and social (Nozick, 1974) world. They also view humans as self-interested and equal in broad capacities. These humans are thus properly motivated and sufficiently capable to master their own fates in a cornucopian environment. Accordingly, individualists evince low-grid preferences, relying primarily on self-regulation among persons. Government, with its inherent coercion, should be limited. They reveal their low-group position in preferences for working through networks of persons linked by voluntary contractual relations rather than through ascribed groups.

Egalitarian

Egalitarians experience low grid and high group. They live in voluntary associations where everyone is equal and the good of the group comes before the good of any individual. In order to maintain their solidarity, egalitarians are sensitive to low probability-high consequence risks (such as nuclear power), and use them to paint a picture of impending apocalypse. *Risk and Culture* was, in part, a polemic against the environmental movement, which Douglas and Wildavsky saw as sharing the worldview and social organization of religious cults. Egalitarians advocate the precautionary principle and cling to traditional ways of life that have proven to be sustainable, rather than risking disaster by trying new technologies. Egalitarians see a fragile environment. Not only is nature subject to depredation but social contexts--the inner city--are

easily perverted as well. Egalitarians believe that humans are naturally benign in their motives

and broadly equal in both basic capacities and needs (Gewirth, 1978), thus fitting with this

delicate environment. Yet, humans are easy prey for destructive social stratification. Egalitarians

believe that by undoing natural human equality, stratification creates arrogance in the dominant

and resentment in the dominated, perverting in the process the natural goodness of all.

Accordingly, egalitarians exhibit a high-group position, preferring to deal with the hazards posed

by fragile environments through the collective resources of close-knit groups that share a limited

material bounty fairly equally--exemplified by the aphorism "live simply so that others may

simply live" or as Schumacher (1973) had it, "small is beautiful." These groups are ideally

relatively small and manifest their low-grid position by reaching collective decisions through

open discussion resulting in consensus (Downey, 1986; Zisk, 1992).

Hierarchist

Hierarchists experience high grid and high group. A hierarchist society has a well-defined

role for each member, like the caste system in India. Hierarchists believe in the need for a well-

defined system of rules, and fear social deviance (such as crime) that disrupts those rules.

Hierarchists see nature as "perverse/tolerant": it can be exploited within certain limits, but if

those limits are exceeded the system will collapse. They thus rely heavily on experts, who can

identify those limits and establish rules to keep society within proper bounds. Experts in various

matters are required to discern crucial natural and social boundaries not equally evident to

everyone as well as for ascertaining how humans should adjust their behavior in conformity with

these limits. For this high-grid culture, then, many of the obvious interpersonal differences in

specific talents that low-grid individualists and egalitarians believe to be morally and socially

inconsequential take on significance. Hierarchists' high-group position appears in their preference for organizing societies into vertically arrayed collectives. High-grid preferences appear in the way these institutions bring experts and ordinary persons together, the former providing the dual services of education and social control for the latter. Authorities thus occupy ordinary persons with sanctioned activities, simultaneously improving their lives and enabling them to contribute more appropriately to society.

Fatalist

Fatalists experience high grid and low group. They feel isolated in the face of an external world imposing arbitrary constraints on them. They view nature as a ball on a flat surface, rolling randomly in any direction. Thus, they feel that there is little they can do to control their situation, and resign themselves to riding out whatever fate throws at them. Because of their passive stance, fatalists are often excluded from Cultural Theory analyses. So persons draw on their cultures not only to interpret the world (North, 1995, p. 17; Scott, 1985, p. xvii) but also to shape it (Ross, 1997, p. 64), building distinctive institutions that realize their rival beliefs and values. Their perceptions of matters such as the world about them, their fellow humans, and the forms of social relations appropriate for these humans under such conditions provide crucial guidance for institutional development. I develop this thesis by drawing on two examples--one American, the other German--of persons employing their cultural beliefs and values to shape institutions in distinctive predictable ways.

The Grid/Group framework makes people aware of the cultural foundations of a group, and perhaps facilitate dialogue between them. According to Evans (2007), for instance, any attempt to "improve performance" commits the Fatal Conceit because it pre-assumes a certain

mixture of egalitarianism, hierarchy, individualism and fatalism that can never be objectively determined. The best we can hope for is to judge performance, separately, in the eyes of *all* of the cultural types. According to the individualist, good performance means a high rate of revenue, profitability, and, (if it's a public company), a rising share price. The egalitarian will judge performance in accordance to the role the organisation plays in its surrounding community, and the enjoyment and pleasure that the employees have in working together. To the hierarchists, a successful organisation is one that has an increasing number of employees, (and therefore is growing physically, with an increase in the number and scale of plants), and systems of rules that can accommodate greater numbers and maintain objective measures of efficiency. And finally, the fatalist will judge an organisation to be performing well as long as it offers stability, and asks for little in return. The first step to begin prescriptive advice on corporate performance would be to accurately measure it (Evans, 2007).

Advantages and Limitations of Grid-Group Framework

We now examine how grid-group theory allays each of the two deeper concerns that many scholars voice with respect to cultural explanation. Cultural Theory does not argue for the superiority of any of the biases. The advantages of Cultural Theory theory are manifold: a monistic conception of cultural values is replaced by a pluralistic conception of culture allowing for a variety of motives for action; master objectives, which play out over sequences of moves, supersede immediate objectives that cover only the next act; concentration on how institutional rules influence incentives, though valuable in and of itself, gives way to a parallel consideration of how individuals shape institutions; and the overwhelming concentration on material self-interest, which discomforts so many social scientists who might otherwise be well-disposed to

rational choice explanations, opens up into a diversity of selves who construct a variety of interests in the service of different ways of life (or cultures) (Wildavsky, 1994).

There is, to be sure, a cost attached to replacing a single self, a single interest or objective, with multiple selves and their varied interests. Grid-group theory's concept of culture is less susceptible to problems frequently associated with theories of cultural dimensions. First, grid-group theory includes inherent safeguards against global favoritism of one culture. Each of the four rival ways of life makes distinctive socially valuable contributions to the multicultural societies that they comprise (Lockart, 1999). As J. S. Mill (On Liberty) suggests, individualistic influence is crucial for the development and sustenance of individual rights. Persons armed with these rights have produced unprecedented degrees of one vision of social progress in some Western societies. This vision employs personal liberty and market (efficiency)-driven technological progress to realize economic prosperity. This combination of institutions is unique to individualism (Olson, 1993).

Culture's centrality to social explanation depends on how it is conceived. As Eckstein (1988) laments, "The term culture, unfortunately, has no precise, settled meaning in the social sciences" (p. 801). In part, grid-group theorists conceive of culture as the beliefs and values with which various factions justify their rival ways of life (Thompson et al., 1990, pp. 1-38). But grid-group theorists also recognize cultures in the distinctive institutions that arise from these social-relations preferences (Douglas, 1986; Katznelson, 1997, pp. 105-106). This theory illuminates tighter, more specific relations between disparate constrained sets of practical objectives and interests that rival clusters of beliefs and values foster and the distinctive institutions that embody these sets than other theories of political culture. This characteristic

enables theorists to capture key features of persons' political worlds more effectively. Thus, grid-group theory generates clearer, more easily measurable concepts than alternative theories of political culture.

Tighter linkages between rival sets of beliefs and values and the distinctive institutions they construct create clearer indices of culture. These indices contribute, in turn, to more empirically testable propositions (Coughlin & Lockhart, 1998; Dake & Wildavsky, 1990; Ellis & Thompson, 1997). We can extend earlier applications of grid-group theory by employing it in the explanation of political change. According to this theory, culture arises from experience, and earlier work applying the theory to this task argued that historical contingencies change cultural biases through surprise. That is, the world no longer works the way one's culture predicts--for example, individualists' faith that conscientious effort will be rewarded (Thompson et al., 1990, pp. 69-93).

This is the sort of change that prior cultural dimensions preclude. Grid-group theory is less restrictive. Two points are pertinent to a clarification of differences. But grid-group theorists do emphasize the lifelong character of socialization and think that extraordinary events in later life may override aspects of earlier socialization. For grid-group theory, culture provides a conception of how the world works that supports certain forms of social behavior as moral and prudent. If persons' experiences provide clear messages that the world is no longer working the way it was once perceived to do, we should not be surprised if some persons, particularly those with hybrid cultural biases apply a different culture (Lockhart, 1999).

It seems reasonable to point out certain limitations to various applications of grid-group theory as well as some likely ways in which these limitations might lead to refutations of

particular applications. First, the various historical contingencies on which my examples have drawn, although possibly less contingent from other theoretical perspectives, are likely to be unpredictable as to timing and strength. In any case, grid-group theory makes no claim to being able to make such predictions (Lockhart, 1999).

Cultural concepts of time are not immediately perceptible or distinct but when they are examined it becomes apparent that they represent strong normative forces affecting both the behaviors and cognitions of members of the culture. Other cultures have other concepts of time and future. Durkheim discusses the subtle power of social time when he argues that, to the extent that social time exercises a restraint or compulsion on the individual it lies outside individual consciousness, so to understand it one must look to the sociocultural factors that create it (Durkheim 1915). The character of temporal perspectives often depend on the way technological development has affected the relationship between people and their natural environments and the consequent ability of people to meet their needs. Social structures such as politics and economics, cultural history and ideas found in religion, philosophy and language also contribute to ideas about time. The order brought by those structures is not uniform, however. Kluckhohn is among those who have shown how variants of the culture's dominant pattern of value-orientation appear in particular sub-cultures in contrasting ways. Ideas about time vary within sub-cultures (Kluckhohn 1953).

According to Lockhart (1999), it is not yet clear how widely, strongly, and persistently grid-group theory's cultures are held among various political actors. Among the general citizenry doubts remain about the strength and persistence of cultural influences, although evidence suggests that both increase with citizen activism (Ellis & Thompson, 1997). Thus, it seems likely

that among political elites, cultural orientations are sufficiently strong and stable to bear the explanatory burden of Grid-Group framework. Yet, culture may not regularly overwhelm other sources of preferences. Hence, Lockhart (1999) argue that grid-group theory is most fruitfully employed in a specific range of situations. Theorists can model individualists' actions in these situations, but the actions of adherents of other cultures likely appear to them as "irrational norms" (Elster, 1989). Grid-group theory reveals these situations as straggles among rival cultures, each striving to realize efficiently or rationally distinctive clusters of constrained and predictable values, practical objectives, and interests.

This improved recognition of distinctive sets of culturally constrained objectives helps us to avoid reliance on ad hoc devices such as "nonrational norms" (Wildavsky, 1991a). More than simply contributing to institutional analysis and rational choice theory, grid-group theory's conception of culture helps to weave together aspects of these modes of analysis that are currently distinct, often competitive, practices. Grid-group theory identifies the high-priority sociopolitical objectives of the adherents of rival cultures. Thus, the theory specifies distinctive, constrained, and predictable objectives and interests for each culture (Lockhart, 1999). According to Lockhart (1999), Benjamin Davy's book, *The Essential Injustice* (1997), illustrates the theme from disputes about disposing of nuclear waste. As the title suggests, it is essential for each culture to believe that the other cultures cherish wrong-headed concepts of justice, they are based on essentially immoral precepts. His analysis takes us far into the central theme of Cultural Theory, irreconcilable conflict.

According to Douglas (2007), here is a dispute between two who will never agree. No new facts will change the opinions of the pioneering individualist who cheerily asserts that all will be well, or those of the holy man who warns him of terrible dangers to be unleashed if he continues in

his ways. Whatever information is tendered, their differences are irreconcilable. Current political contests between Christianity and Islam are in this class, so are the debates about global warming. For such important issues each side devotes large funds to research for new facts about the alleged dangers, but no new facts will resolve the issues. The views are irreconcilable because each party is speaking from a different cultural platform. The ideas exchanged stand for particular values embedded in interlocking institutions. Grid and group, or CT as it is now called, can deconstruct irreconcilable differences by identifying the particular type of civilisation which the culture upholds (Douglas, 2007).

Because moral judgments are entailed by cultural models (and they always are, for culture is a moral system), the unthinking application of one's own models inevitably bring about subjective evaluation of behaviors. When the differences cannot be reconciled, the protagonists seem to be behaving irrationally. In cultural conflict compromise counts as betrayal. Opponents dismiss out of hand evidence from other kinds of institutions. According to CT, their intransigence is neither irrational nor immoral. It expresses their loyalties and moral principles, and their responsibilities to other members of their society. The message for research is never to consider conflict of opinions without looking for the underlying conflict between institutional forms. Cultural attack and persecution are the spice of life for a community (Douglas, 2007).

While lack of empirical comparison data make our results tentative, we conclude that the Grid-Group framework retains the advantage of parsimony as the single most powerful predictor of culture change across a range of social and political issues. Grid-group theory allows us to unpack distinct social logics that are conflated in traditional unidimensional models. These logics not only tell us more about the bases for persons' attitudes, they offer an explanation for the

shifting structure of political conflicts and coalitions. Thus grid-group theory opens up into a

diversity of selves who construct a variety of interests in the service of different ways of life (or

cultures).

<div style="text-align: center">References</div>

Davies, B. (1997). E*ssential Injustice, When Legal Institutions Cannot Resolve Environmental and Land Use Disputes,* Springer.

Bond, M. H. (1994). Into the heart of collectivism: A personal and scientific journey. In U. Kim et al. (Eds.), *Individualism and collectivism: Theory, method, and applications* (pp. 66-76). Thousand Oaks, CA: Sage.

Broom, L., P. Selznick, and D. Broom-Darroch, 1981, Sociology (New York: Harper and Row).

Clifford, J., & Markus, G. (Eds.). (1986). *Writing culture: The Poetics and Politics* Berkely: University of California Press.

Coughlin, R. M., & Lockhart, C. (1988). Grid-Group Theory and Political Ideology A Consideration of Their Relative Strengths and Weaknesses for Explaining the Structure of Mass Belief Systems. *Journal of Theoretical Politics, 10*, 33-58.

Cronen, V., Pearce, B., & Tomm, K. (1985). A dialectical view of personal change. In K. Gergen & K. Davis (Eds.), *The social construction of the person*. New York: Springer-Verlag.

Douglas, M., &Wildavsky, A. (1982). *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers*. Berkeley, CA: University of California Press.

Douglas, M (1992). Risk and blame: essays in cultural theory. London and New York: Routledge; 1992.

Douglas. M. (2007). A history of grid and group cultural theory. Retrieved http://www.chass.utoronto.ca/epc/srb/cyber/douglas1.pdf.

Durkheim, E. (1915). *The Elementary Forms of the Religious Life*. New York: The Free Press.

Eckstein, H. (1996) 'Culture as a Foundation Concept for the Social Sciences', *Journal of Theoretical Politics* 8: 471–97.

Eckstein, H. (1997) 'Social Science as Cultural Science, Rational Choice as Metaphysics', in Richard Ellis and Michael Thompson (eds) *Culture Matters.* Boulder, CO: Westview.

Etzioni, A. (1968). *The Active Society.* New York: Free Press.

Evans, A. J. (2007). Towards a Corporate Cultural Theory. In Squire, C. (2000) (Ed.), *Culture in psychology*. London: Routledge.

Fabian J. (1986). *Language and colonial power.* Berkeley, CA: University of California Press.

Fiske, A. P., Kitayama, S., Markus, H. R., & Nisbett, R. E. (1998). The cultural matrix of social psychology. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social Psychology* (Vol. 2, pp. 915-981). Boston, MA: The McGraw-Hill Co.

Hofstede, G. (1980). Culture's consequences: International differences in work-related values. Beverly Hills, CA: Sage.

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations* (2nd ed.). London: Sage.

Kim, M. -S. (2002). *Non-Western perspectives on human communication.* Thousand Oaks, CA: Sage.

Lockhart, C. (1999), Cultural contributions to explaining institutional form, political change, and rational decisions, *Comparativve Political Studies, 32,* 862 –

Martin, F., & Agneta, M. (2007). Development and modernity in Hofstede's Culture's Consequences: A post colonial reading. *Multicultural Discourse,2,* 1-19.

Moreno, C. (February, 1997). *Intercultural communication: Selected epistemological traits through some of its theories, concepts, dimensions and methodology.* Paper presented at the Fourteenth Annual Intercultural and International Communication Conference. Miami, U.S.

Pearce, W. B., & Cronen, V. E. (1980). *Communication, action, and meaning.* New York: Praeger.

Schein, E.H., 1985, Organizational Culture and Leadership: A Dynamic View (San Francisco: Jossey-Bass).

Schwartz, S.H. & Bilsky, W. (1987). Toward a universal psychological structure of human values. *Journal of Personality and Social Psychology, 53*, 550-562.

Shi-xu, & Wilson, J. (2001). Will and power: Towards radical intercultural communication research and pedagogy. *Language and Intercultural Communication, 1,* 76-93.

Thompson, M. (1992) The dynamics of cultural theory and their implications for the enterprise culture. in S. H. Heap and A. Ross (eds), *Understanding The Enterprise Culture*, Edinburgh; Edinburgh University Press.

Trompenaars, F. (1993). *Riding the waves of culture.* Nicholas Brealy, London.

Wildavsky, A. (1991a). "Efficiency as a function of culture." *Administration in Social Work, 15*,147-153.

Wildavsky, A. (1991b). The internal transformation of the major political parties: Democratic activists are increasingly egalitarian, republicans individualistic and hierarchical. In Wildavsky, A., *The Rise of Radical Egalitarianism.* Washington, D.C.: The American University Press.

Wildavsky, A. (1994). Why self-interest means less outside of a social context?: Cultural contributions to a theory of rational choices. *Journal of Theoretical Politics, 6,* 131-159.

GRID/GROUP CULTURAL THEORY AND BEHAVIOR IN VOLUNTARY CONTRIBUTIONS PUBLIC GOODS AND BARGAINING EXPERIMENTS[1]

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Abstract

We measure subjects along grid and group cultural dimensions using survey questionnaires to predict variations in behavior in voluntary contribution mechanism with and without punishment and bargaining experiments. Grid was hypothesized to induce enforcement of social norms of reciprocity, and group to induce altruism towards other individuals. Overall, it was shown that the group attribute was positively and significantly correlated with the level of individual contribution and offers. The grid attribute was positively correlated with willingness to punish, and significantly so for treatments where team membership was shuffled from round to round. Hence cultural type was shown to have a significant effect on performance in games, contrary to predictions of conventional models.

JEL classification codes: C70, C91, D64, M14, Z1.

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1. Introduction

The role of culture in collective human performance is a natural object of study in this age of globalization, with multinational workforces increasingly becoming the rule in both the private sector and government. Within the military, the necessity for individual soldiers to work with multinational coalitions is becoming more and more prevalent. Alesina and Ferrara (2005) analyze the tradeoff between benefits of broadening with diversity and cost of heterogeneity on economic performance pointing that diversity may affect the economic performance in three ways: preferences, strategies and production function. Stock (2004) reviews controversial effect of diversity and culture on group performance found by empirical studies from organization theory, marketing research, human resource management, and psychology. Classical economic theory virtually ignores heterogeneity assuming homogenous agents maximizing own utility function which does tie to no others' utility functions. However, recent studies on social preferences demonstrate that social motives such reciprocity (Rabin 1993, Dufwenberg and Kirchsteiger 1998, Falk and Fischbacher 2006, Charness and Rabin 2002), inequity aversion (Bolton and Ockenfels 2000, Fehr and Schmidt 1999), and altruism (Andreoni and Miller 2001) are the underlying reasons of human behavior. Another approach to study how culture/ heterogeneity affects a group performance is presented in Weber and Camerer (2003), in which distinct languages developed within the firm to perform a real task prevents its mergers with another firm. Third, several studies examine a cross-cultural difference employing subjects from more than one country. For example, Henrich et al. (2001) provide evidence there was a great deal of variability in the ultimatum game outcomes across fifteen small scale societies due to market integration and different levels of payoff for cooperation. Yamagishi and Yamagishi (1988) find that Japanese have more general level of trust than Americans. Contrary, Buchan and

Croson (2004) data support more general level of trust among Chinese as in comparison to USA population. Further, a growing literature based on the identity theory documents in-group favoritism and out-group discrimination. Buchan and Croson (2005) find that temporary induced groups in USA favor own discussion group, but Chinese sent and returned more to the out-group. Experiments by Chuah et al. (2009) reveal that group favoritism was more pronounced among Malaysians and their offers made to UK responders were sensitive to the experimental location, i.e. proposers playing on the foreign soil make larger offers than home proposers. Fourth, differing from above approaches, a number of studies look at either induced or ethnic group identity. Eckel and Grossman (2005) show that pre-production goal enhances the effect of identity in minimum groups. Charness et al. (2007) suggests that with group membership subjects tend to behave nicely toward in-group members. Chen and Li (2009) study reveal that subjects reward the in-group member more for good behavior and punish the in-group member less for misbehavior in comparison to out-group match. Experiments by Chen et al. (2008) reveal that Asians favor in-group while Caucasians favor in-group only when school identity is salient. Sherry, Oliveira and Eckel (2008) study the neighborhood effect among African-Americans. In-group favoritism was evident in naturally occurring groups such as Swiss platoons (Goette et al. 2006), ethnic groups in Uganda (Habyarimana et al. 2007), and among two ethnic groups in Papua New Guinea (Bernhard et al. 2006). Ethnic group status was one of the factors that affected discriminatory preferences toward Khmer minority on behalf of Vietnamese majority and Chinese minority (Tanaka et al. 2010).

Our paper contributes to this body of literature by combining laboratory experiments with a new methodology to measure cultural attributes, therefore social preferences. The paper focuses at its core on the novel objective to "determine which cultural factors are most

statistically relevant as performance moderators". We do so by incorporating the role of two cultural factors in particular, grid and group, the basis for perhaps the most prominent general framework for cultural classification in the social sciences. It is based on the work of preeminent cultural anthropologist Mary Douglas (1989) and pioneering political scientist, Aaron Wildavsky (1987), as well, on their joint work (Douglas and Wildavsky, 1982). Grid-group has been adapted to a formal, choice-theoretic decision-making framework (Chai and Wildavsky, 1998). Grid and group are quite different from most cultural typologies such as those of Hofstede (2003), House et al. (2004), Chhokar et al. (2007), or Hampden- Turner and Trompenaars (1993). One distinction is that it has only two major factors, as opposed to the several found in comparable typologies. Moreover, these factors tend to be more abstract. This abstractness can be seen, indeed, as one of the framework's great advantages, as its concepts viewed as being relevant to literally all choice situations that an individual will fact in a group setting (Douglas 1989; Douglas and Wildavsky 1982; Chai and Wildavsky 1998; Chai and Swedlow 1998). It has been compared at time to the pioneering concepts of integration and regulation by 19th century sociologist Emile Durkheim (1997 [1897]), for their ability to capture within a small number of dimensions much of what makes cultures different from one another.

Within the grid-group model, group represents the extent to which a culture emphasizes positive or negative altruism towards other individuals, as opposed to pursuit of self-interest. Grid, on the other hand represents the extent to which a culture embodies a reliance on standardized role-based rules for achieving goals, as opposed to general approaches to problem-solving. Grid-group surmounts many of the limitations associated with previous theories of cultural dimensions. This framework proposes that an individual's behavior, perception, attitudes, beliefs, and values are shaped, regulated, and controlled by constraints that can be

classified within two broader domains labeled as group commitment and grid control. Beliefs about humans and their world locate persons with respect to the grid and group dimensions and spawn preferences for specific patterns of social relations. The grid-group model is more than simply a taxonomy. Both grid and group have implications for a wide range of actions across diverse environments. Stated in basic fashion, low-group cultures will tend to have self-interested preferences based upon a individualized identity, while high-group cultures will be characterized by altruistic preferences towards others within their own collectivity, based upon a "fused", collective identity. High-grid cultures will tend to prefer to adherence to rules of conduct based on social norms, particularly those of equity and reciprocity within the collectivity, even under conditions where this does not directly benefit them. Low-grid cultures, on the other hand, will tend to ignore such norms and decide to do things "their way". These are general tendencies, and hence are not tied to any particular set of conditions or interactions.

This paper introduces a methodology that builds a cultural profile of subjects using survey questionnaires, and then uses the results to predict variations in behavior in controlled computer-mediated experiments across a range of conditions. 132 subjects were provided with pretest surveys, which were used to generate measures for each subject along grid and group. Grid was hypothesized to induce enforcement of social norms of reciprocity, and group to induce altruism towards other individuals. These subjects were then placed in computer-mediated experiments involving ten rounds of a Voluntary Contribution Mechanism (VCM) within teams of four. Treatments were varied according to whether team membership were shuffled between stages, and by whether information was provided on team member responses to a question on appropriate contribution. Overall, it was shown that the group attribute was positively and significantly correlated with the level of individual contribution across all treatments. Individuals

were then placed in a modified VCM in which team members were able to punish, at cost to themselves, those who failed to contribute. It was shown the grid attribute was positively correlated with willingness to punish across all treatments, and significantly so for treatments where team membership was shuffled from round to round. Further group attribute was significantly positively correlated with offers in the ultimatum game. It is thus demonstrated that general cultural dimensions can be used to predict differences in behavior under widely varying conditions. Our contribution is twofold; first we incorporate the grid/group cultural typology in to the analysis. In addition, we provide a measure of individual's preferences through the survey. The paper proceeds as follows. In section 2 we provide predictions and hypothesis to be tested. In section 3 we describe experimental design followed by section 4 where we report main results from laboratory. We discuss results and conclude in section 5.

2. Predicted behavior in the VCM with and without punishment

We aim to capture the effect of cultural factors such as grid and group on individual's behavior as well as group performance in a voluntary contribution mechanism (VCM). In our experiments in groups of four subjects experience ten periods of VCM. Every period each subject is endowed with fifty tokens to invest in two exchanges. The group exchange generates half of the total amount invested in that exchange and benefits everyone in that group, i.e. efficiency factor is equal to two. The individual exchange returns exactly the same amount of what is invested in it and exclusively benefits the investor.

We can characterize individual-level payoffs in each period of VCM as follows:

$$x_i = (50 - c_i) + 0.5 \sum_{j=1}^{N} c_j , \tag{4}$$

where $0 \leq c_i \leq 50$ represents the contribution of individual i, and $\sum_{j=1}^{N} c_j$ total contributions of all

individuals in a group. Conventional theory predicts no contributions in both the finitely repeated

and one-short VCM games assuming self-centered individuals. According our model the

formalization of groupness allows an individual to appropriate some of the team payoff as part of

his or her own utility, thus increasing the incentives for contribution. Therefore, we would expect

that high groupness individuals would contribute more than the low groupness individuals. In the

VCM with no regularities reciprocators condition their behavior upon others and reduce

contribution (Fischbacher et al., 2001). A different outcome is expected under conditions where

punishment is possible. Fehr and Gachter (2000) find that allowing a second stage in which

subjects can punish other subjects after observing their contribution levels raises the level of

contribution to the group account and stems the speed of contribution decay. Indeed, Carpenter,

Bowles, and Gintis (2007) find strong reciprocity could be one factor increase performance in

team if punishment opportunities exist. A public good experiment with punishment (Fehr and

Gachter 2000) is similar to a VCM, except for the fact that, after contribution, there is an

additional stage in which individuals may punish others whom they do not think contributed

sufficiently to the public good. This punishment incurs a cost to both the punisher and punishee,

so there is no benefit to doing so except to promote a "just" outcome and, in a repeated game, to

deter further failure to contribute.

Immediately after the completion of the VCM rounds, we administered another ten rounds of

VCM with punishment opportunity; we call this game enforcement contribution mechanism

(ECM). In this game, after the investment decisions, subjects are allowed to assign points to any

other subject within the group whom they think violated the norms. The points assigned to

individuals reduce the payoff of the receiver by 10 percent per each point assigned, with the

constraint that an individual's payoff cannot be reduced by more than 100 percent. Our enforcement contribution mechanism (ECM) differs from punishment games in Fehr and Gachter (2000) in that each point assigned to others costs the punisher 5 cents, i.e. non-increasing in the punishment level. Also in our setting endowment and marginal per capita return for the group exchange are higher, i.e. e=50, MPCR=0.5. From this, it follows that

$$x_i = [(50 - c_i) + 0.5 \sum_i c_i] \cdot (10 - P_i)/10 - \sum_j 5 \cdot p_i^j \qquad (5)$$

where $P_i = \min(\sum_{j \neq i} p_j^i, 10)$ is the deciles reduction in payoff to penalty recipients due to assigned penalty points, and p_i^j is the number of penalty points given out by individual i to each other individual j. Classical theory predicts no contributions in the ECM because self-centered individuals refute to punish others due to a costly activity. Since no one punishes, everyone free rides. However, punishment of failure to contribute is a form of strong reciprocity, a social norm that is accepted in by most experimental social scientists to be one (and perhaps the only one) that is universally shared in by all societies. If an individual can commit to punishing failures to contribute in the partner treatment either due future benefits of cooperation (direct reciprocity) or reputation building (indirect reciprocity), and the other individuals in the team are aware of this, these individuals may choose to contribute because the cost of receiving punishment exceeds any individual benefits from failing to contribute. For the one-short VCM games with punishment opportunity, we posit the existence of a norm of strong reciprocity that occurs to some extent across all cultures, but is stronger in some cultures than others. Stated formally, strong reciprocity is an individual-level norm that calls for rewarding those who act cooperatively and punishing those who do not, even when following such a pattern of reward and punishment is costly to oneself (Fehr, Fischbacher, and Gachter 2002). The focus on reciprocity is justified by

ample experimental evidence which suggests that this norm can account for much of the

deviation of individual behavior from that predicted by conventional economic theory (Fehr and

Gachter 1998; Andreoni 1995; Falk and Fischbacher 2006; Bolton and Ockenfels 2000). Given

the existence of strong reciprocity as a social norm, our formalization of grid implies that

cultures that are higher in gridness will be more willing to give up their own benefits and engage

in costly monitoring activity in order to restore social norms. Thus the existence of gridness

makes reciprocity stronger than its absence, and hence leads to more enforcement. Within the

context of this experiment, where assigning penalty points to non-cooperators is helpful in

enforcing cooperation, and thus beneficial to the group, it follows that high-grid individuals will

be more likely to assign penalty points than low-grid individuals. Hence, we would expect

individuals with high gridness characteristic to have higher punishment abilities in the VCM

with punishment opportunity (ECM hereafter). We test the following propositions:

Hypothesis 1: High-group individuals contribute more than the low-group individuals in the

VCM.

Hypothesis 2: High-grid individual will punish more than the low-grid individuals in the ECM.

Hypothesis 3: High-grid individuals will react more radically to initial contributions by others,

rewarding high contributions and punishing low contributions.

Hypothesis 4: High-group individuals will anticipate higher cooperation among others than low-

group individuals.

Hypothesis 5: High-grid individuals will anticipate greater adherence among others to strong

reciprocity than low-grid individuals.

In many ways, our research seeks to improve on the above mentioned approaches by

integrating the use of the grid-group framework to better characterize cultural variables. Grid-

group theory can not only help explain the differences between specific nationalities/ethnic groups, but can show how they can be generalized to other countries and other types of interactions. Moreover, it shows how it is possible to go beyond stereotypes of national character and examine cultural differences at an individual and sub-national level. We test the importance of cultural factors in sustaining high levels of contribution to the group account. Specifically, we hypothesize that high-grid (strong reciprocity) and high-group (altruism) characteristics are among the explanations for patterns in contributions.

3. Predicted behavior in Ultimatum Game

We aim to capture the effect of cultural factors such as grid and group on individual's behavior in a bargaining game. We examined the nature of human cooperation in a bargaining game where each proposer is given an endowment of 10 dollars to divide between himself/herself and a responder. After the proposer makes an offer, the responder can either accept or decline. If the responder declines, neither party receives anything (Guth, Schmittberger, and Schwarze 1982). For the self-interested norm-neutral rational actor, the optimal strategy in an ultimatum game is to offer nothing if they are the proposer, and to accept any offer above zero if they are the responder. However, laboratory experiments report that most of subjects offer almost half of the pie and reject even reasonably high offers. A number of different explanations have been put forward for this seemingly anomalous behavior. Some attribute this to concerns about kindness (Rabin 1993) or fairness (Bolton 1991). Note that kindness and fairness are clearly different concepts. Within the context of the ultimatum game, kindness refers to the willingness to offer a bigger share to ones partner, even when there is not an obvious benefit to oneself for doing so. Fairness relates to ones willingness to accept or reject an offer based upon what seems appropriate for the partnership, rather than what is personally beneficial to oneself. In the convex

ultimatum game Andreoni et al. (2003) have shown that money maximization is a concern of about the half of subjects and another half of population are concerned about fairness.

Cross-cultural experimental studies from fifteen small scale societies provide evidence there was a great deal of variability in behavior across societies in their behaviors both as proposers and responders (Henrich et al. 2004). Grid-group theory can help to explain both these findings. The cultural characteristics assumed by conventional economic theory are not universal in real life, but are limited to those who are of low-grid, low-group culture. Moreover, if we know the grid and group characteristics of different individuals, we may be able to predict how their behavior will differ in the proposer and responder roles. The role of a proposer identifies the groupness characteristic, since offering a greater amount is only rational if an individual incorporates the responding partner's payoff into his or her utility function. Therefore, we would expect that high-groupness proposers will offer more than low-groupness proposers. The role of a responder isolates the gridness characteristic of the individual, since rejecting an offer is harmful to the payoffs of both proposer and responder, hence is rational only if it allows the responder to follow a social norm, in this case the norm of reciprocity. Thus, we would expect that high-gridness individuals will be more likely to reject offers than low-gridness individuals. In the ultimatum game we test following propositions:

Hypothesis 6: High groupness individuals, when placed in the offerer role, will be more likely to make high offers than others.

Hypothesis 7: High gridness individuals, when placed in the receiver role, will be more likely to reciprocate others (accept high offers, reject low offers).

4. Experimental Procedures and Design

4.1. Survey method

   We conducted a survey before each experiment to determine the cultural characteristics of each

subject. Cultural characteristics for each individual are quantified based on answers they pursue

during a survey consisting of 29 questions, which transmits information on personal values with

respect to the following key elements: (i) social values, (ii) opinion on employment, (iii) national

goals, (iv) social distance, (v) workplace, (vi) religion and (vii) social norms. See the attached

survey for details. We calculate grid [2] and group[3] indexes in line with the formula in the

footnote. This method for calculating grid and group is determined by taking selected items from

the World Values Survey (Inglehart et al. 2004). For reasons of robustness, two additional

questions were placed on the survey, each being original items that seek to encapsulate in a

single indicator the qualities that make up grid (Answer[7]) and group (Answer[6]). These

single-question indicators are named Alt Grid and Alt Group as compared to Grid and Group

indexes calculated using several questions.

        Previous attempts to incorporate survey instrument linked trusting attitudes with trusting

behavior in experiments (Glaeser et al. 2000, Fehr et al. 2002, Ahn et al. 2003, Ashraf et al.

2006, Danielson and Holm 2003) or trusting attitudes with contributions in the public good game

(Gächter et al. 2004, Capra et al. 2008). It has been found that attitudinal trust questions predict

well trustworthiness rather than trusting actions (Glaezer et al. 2000, Fehr et al. 2002). Out of

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[2] Grid=((4-Answer[10])/3+(3-Answer[13])/2+(3-Answer[14])/2+(3-Answer[17])/2+n(2-Answer[18])/1+(3-Answer[22])/2+(Answer[25]-1)/9+(10-Answer[26])/9+(10-Answer[27])/9+(10-Answer[28])/9+(10-Answer[29])/9)/11;
[3] Group=((4-Answer[8])/3+(4-Answer[9])/3+(2-Answer[11])/1+(2-Answer[12])/1+(Answer[15]-1)/1+(Answer[16]-1)/3+(3-Answer[19])/2+(3-Answer[20])/2+(Answer[21]-1)/2+(Answer[23]-1)/9+(10-Answer[24])/9)/11; The Answer[1], Answer[2] are the numbers that quantify and identify the exact answers provided by subjects in the survey.

several measures of trust attitudes it has been found that General Social Survey *(GSS) trust* question poorly reflects actual behavior while the *Trust strangers* and the *GSS fair* and *GSS help* questions were reliable in predicting cooperative actions (Gächter et al. 2004). Capra et al. (2008) used World Value Survey (WVS) and GSS trust questions to explain trusting and cooperative behavior in a series of games and find predictive power of trust questions controlling for altruism. Chuah et al. (2009) explain the differences in the ultimatum game behavior among residents of Malasya and UK by their different responses to WVS attitudinal questions. However, none of these studies attempted to measure social preferences through attitudinal questions. Differing from, studies that measure the impact of social motives on behavior examine allocation decisions through the ring test (Offerman et al., 1996; Sonnemans et al., 1998, Van Dijk et al., 2002, Liebrand, 1984). The psychology personality questions are used to sort types based on their altruistic scores (Ma et al. 2002). Our survey instrument measures both the reciprocal preferences in addition to altruistic preferences to predict behavior in public good games.

4.2. Laboratory experiment

Total of 132 undergraduate and graduate students participated in one of the experimental sessions during February 2008. First they were prompted to University of Hawaiʻi Laboratory for Computer-mediated Experiments and the Study of Culture (HCXC) computer[4] terminals to take the questionnaire. Then subjects have experienced (i) a voluntary contribution mechanism with no punishment (VCM) in ten periods followed by, (ii) the voluntary contribution mechanism with punishment (ECM) in ten periods followed by (iii) one period of ultimatum game (Table I). After the completion of the questionnaire subjects were aware of only ten periods of the no

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[4] The experiment was programmed and conducted with the software z-Tree (Fischbacher 2007).

punishment VCM condition. Subjects were told that there would be exact ten periods of VCM and ECM and one period of ultimatum game. However, they were aware of no other following games until each game proceeded.

Based on three basic conditions we built four designs where subject's matching and framing conditions vary. In designs 1 and 3 (Table I) subjects are placed in the same group for the duration of the treatment (partner matching). Design 2 and 4 simulate one-shot games with and without punishment such that subjects are re-matched randomly after each period (shuffled groups). In each treatment, subjects are made aware of these rules for group composition and are aware that this knowledge is common across all subjects. All VCM, ECM, and ultimatum game conditions were tested in the different contexts of partner matching (iterated) and random matching (one-shot game) to separate fully the strong reciprocity motive from selfish motive to punish. A strong reciprocal individual (high-grid) acts contingent on the contribution of other members and is willing to discipline non-cooperative members at her/his own cost. However, a low-grid and low-group individual (selfish) also has a motive to punish others in the current period as a means of inducing increased contributions from others in the next period. To isolate the effects of strong reciprocity, treatments with random re-matching (design 2 and 4) eliminate the selfish motive to punish. In addition, there is no reputation effect when subject is placed in a group with different team members after each period.

In designs 3 and 4 we study framing effect on top of this. Designs 3 and 4 include a preliminary stage to elicit from subjects their expectation of fair contribution levels. In order to enhance the presence of social norms within the group we report average group opinion about fair contribution. The average answer is reported back to the subjects before the treatments commence. This is meant to create a "frame" for subjects, a collectively shared norm against

which the actual contributions can be compared. Designs 1 and 2 do not include this framing stage.

In the no punishment VCM condition, after the contribution stage subjects received information on the total group investment and own payoff for this stage. Also they receive information on contribution levels in their group. In every condition, individual's contribution was listed in the first place and contributions of other members were followed in the random order so that there was no possibility of identifying other' contributions. This way we remove reputation building effect in the partner matched groups and rule out possibility of revenge type punishment that could be carried over from the previous period to the current period. In the punishment condition subjects did receive information only on their own punishment expenditure, total punishment points assigned to them by others and the following reduction in their own payment. Subjects neither received information on the individual punishment activities of other members nor overall punishment level in the group. Subjects did not know about the ultimatum game prior to ten periods of ECM. However, all subjects were informed about the partner or stranger pairing before the ultimatum game where each subject was placed in the role of a proposer first without knowledge of the payoff; then all subjects were placed in the role of a responder given the actual opponent's offer levels.

Every effort was made to employ neutral language. For instance, the word "investment" is used instead of "contribution". To ensure that subjects understand the nature of the institution and payoffs, subjects complete a quiz and two practice periods before treatment starts. After the experiment, a questionnaire is administered to ascertain the participants' strategies and opinions about the experience. Each subject was paid on average $30 including a flat show-up fee of $5.00 in cash at the end of experiment. Each session lasted about two and half hours including

the payment time. Instructions were provided in verbal and written format before subjects began

the experiment. See Appendix *A* for the instructions[5].

5. Result

We report correlations between grid/group scores and contributing/punishing levels to see the

effect of cultural attributes on the group outcomes. We also analyze data by looking at the

average contribution, mean punishment expenditure across ten periods of VCM or ECM, mean

offers and rejection rate in the ultimatum game.

5.1. *Voluntary Contribution Mechanism Results*

Result 1 *In line with cultural model predictions, high-group scores were positively correlated*

with the average contributions in VCM (hypothesis 1). This result was most pronounced in the

shuffled groups.

Support:

Groupness and contributions: Examination of initial results show confirmation for our

hypotheses, indicating that, according to the institution under which individuals are functioning,

either grid and group can be an important and systematic determinant of individual and team

performance. As seen in Table II, the correlation between individual groupness (Group) and the

average amount (Contrib) contributed across all periods in the VCM, in both shuffled and partner

matched groups, was positive and statistically significant. Hence, it was shown that high-group

individuals tend to lead to higher team performance for the team in the VCM. Note that these

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[5] Instructions are not intended for publication

findings hold for both the indexed and alt versions of the group indicator, and are significant for both, a strong verification of the importance of group for contribution behavior in the shuffled groups VCM. Shuffled groups helped to isolate groupness effect from gridness effect because one-short game structure eliminates any direct reciprocity and reputation building effects. We report pooled data results for the shuffled with frame and shuffled with no frame treatments since as we will show below framing had no effect at all in those treatments.

Table III displays both the average group account contribution levels and the corresponding standard deviations for the various treatments within the VCM institution. Within each, the results are presented for each of the following treatments: the sessions where framing took place, the sessions where framing did not, the sessions where the group composition was maintained through every round (partner), the sessions where group composition was scrambled every round (shuffled). The VCM institution shows an average contribution over all ten periods of 21.5 and 30 for the shuffled and partner conditions. But it is important to note that contributions are clearly highest in the early periods and decay throughout the treatment. The Wilcoxon matched pairs signed-ranks test across time periods shows significant difference among periods (p-value=0). This type of group contribution decay is common in VCMs. However, the decline in contributions toward the end of ten rounds was not sharp, with individual contribution levels at 29-45 percent of endowment.

Result 2 *In the VCM cooperation was higher with partner groups rather with shuffled groups. High-group individuals expect higher contributions by others regardless of a matching condition whereas high-grid individuals expect others to contribute less in the shuffled groups and expect others to contribute more in the partner groups.*

Support:

Matching: There is very clear distinction in the behavior of *shuffled* groups comprised of unique combinations of subjects each round, and *partner* groups whose composition remains unchanged. As demonstrated in prior VCM experiments (Fehr and Gachter 2000), randomly re-matched subjects contribute less to the group account than subjects who are told they will remain matched with the same people through out the treatment. In our data this is demonstrated by the difference in the averages across all periods (shuffled groups contribute 21.5, partner groups contribute 30) and in per period differences as well. Wilcoxon rank-sum test indicates that contributions to the public good are maintained at a higher level in the partner groups (p-value=.0009 and p=0.0015 in the frame and no frame conditions, two sided). See Table III. Average contributions in shuffled groups amount to 43 percent of endowment vs. 60 percent in partner groups.

Framing: Average contributions were 25.5 in both No Frame and Frame shuffled treatments. Similarly, in the partner treatments mean contributions were higher (30) but similar for both No Frame and Frame treatments suggesting that framing induced little or no distinction between subjects with differing grid and group scores (Wilcoxon-Mann-Whitney rank-sum test p-value=.9698 and .8798 in partner and shuffled matching conditions correspondingly, two-sided). High-group individual anticipate higher cooperation among others in the sense that the group scores are positively and significantly correlate with one's expectations of others cooperation (``Norm") for both Group index and Alt group indicator in the shuffled condition (Pearson p-value=0 and .001, respectively). This result is significant in the partner groups as well (hypothesis 4). In line with predictions, grid scores are significantly and negatively correlate with

the expectations on others adherence to norm (``Pnorm") in the shuffled condition while the sign reverses in the partner condition. Therefore, high-grid individuals condition their decisions on their expectations of the norm and others behavior (hypothesis 5). As expected high-grid individuals contributed on average (35 and 37) marginally higher amounts in the partner treatments as compared to (21 in both) in the shuffled VCM conditions (Wilcoxon-Mann-Whitney test p=.0609, p=.0675). As we will show below, high-grid individuals cooperate more in the ECM than in the VCM.

Result 3 *In the VCM with no regulation, high-grid individuals reduce contributions rapidly versus their contributions in the VCM with punishment (hypothesis 3). This is in line with their expectations on others adherence to norm.*

Support

Matched pairs test shows that mean contributions by high-grid individuals were significantly higher in the ECM than mean contributions in the corresponding VCM in all conditions except partner matching (p<.05). Presumably partner matching in VCM generated higher cooperation among high-grid since they do care about norms (Figure Ia-Id). Mean contributions by high-grid individuals in the last period of the VCM were significantly lower than in the last period of ECM (p=.0209).

5.2. *Enforced Contribution Mechanism Results*

Now we analyze the data for the contribution mechanisms with punishment opportunities (ECM) where subjects were allowed to assign points to other members which reduce earnings.

Result 4 *In line with theoretical predictions, high-grid scores were positively correlated with the punishing expenditures in the shuffled groups (hypothesis 2).* The *voluntary contribution mechanism with punishment (ECM) opportunity produces higher level of output than the standard VCM. Partner groups perform better than the shuffled groups.*

Support:

Gridness and Punishment: Results largely in accordance with expectations were also found in the ECM. Here we would expect that the correlation between individual gridness and the average penalty expenditures (Punish) incurred across all periods be positive. We find the correlation is in the expected direction for both the indexed and alt grid indicators, although the level of significance is not as high as needed to be decisive across the various treatments. However, when one focuses in on the shuffled groups with and without frame, the correlation between grid score and punishment is both high and significant (Pearson coefficient=0.230, p=0 and coefficient=0.111, p=.036). This is in line with our expectations as, partner groups provide an incentive for even low-grid individuals to punish those who fail to contribute, since this may lead to higher future contributions from which they themselves can benefit. For the shuffled groups, the only reason to do so would be strong reciprocity.

VCM versus ECM: Table IV shows similar data as Table III but with the addition of the average expenditure on punishment disbursed in the second stage of each period. As demonstrated by Fehr and Gachter (2000), the potential for punishment, even at a substantial cost to the punisher, serves to encourage increased contributions to the group account. In our data, this higher level of contributions is seen in the average across all periods (41.01 versus 35.69 in shuffled, 45.39 versus 36.96 in partner conditions) and in the comparisons across each period. Average contribution across all periods and across ECM is higher than that in the VCM and, what's more,

the contributions display none of the tendency to decay across periods (Figure II). Wilcoxon matched pairs test reveals that contributions in no punishment versus punishment conditions differ significantly from each other at 1 percent level for all conditions except partner groups that exhibit marginally higher contributions in the ECM (Table V). This result again manifests the importance of institutions, existence of norms that supports full cooperation in social dilemma situations.

Matching effect: Not as surprising, the means of group composition, random or invariable, is also a significant determinant of contributions in this institution. The partner treatment results in higher levels of group account contribution across all periods (45.4 versus 36.96 in partner and 41.01 vs. 35.69 in shuffled conditions) just as in the VCM without punishment. Mean contributions were higher in the partner groups with framing than in the random groups with framing (Wilcoxon-Mann-Whitney test p=.0015). Presumably, the potential for punishment in this institution mitigates the inability to reciprocate in the randomly determined groups and thus eliminates the distinct incentive to cheat in those treatments that accounted for the difference in the non-punishment VCM.

Result 5 *Framing strengthens the punishment effect in both partner and shuffled groups. In the partner groups without framing punishment level was higher than in the partner groups with framing.*

Support:

Framing effect: Interestingly, in the ECM, framing has a substantial positive effect on the level of contribution whereas, in the absence of punishment (VCM), it has no effect at all. Wilcoxon rank-sum test in Table IV shows higher average contributions with framing than without frame

(p-value=.0002, two-tailed). The mean contribution was different from Nash level and reached

91 and 82 percent of endowment in the partner frame vs. shuffled frame punishment conditions

respectively. For no frame conditions corresponding contributions remain lower, i.e. 78 and 71

percent. Individual's group scores and contributions remained strong, positive and significantly

correlated for both groups of subjects in the partner conditions (0.164 for those asked and 0.165

for those who were not).

Punishing behavior: The punishment statistics are also included in Table IV. The average per-

person expenditure on punishment were 3.93 in the partner frame, 11.7 in partner no frame, 5.37

in shuffled frame, and 5.29 in shuffled no frame treatments. Interestingly, there was no decay in

the level of punishment contributions across all periods despite the value of punishment as an

inducement for future contributions would decrease each period. There are also obvious

treatment effects. For starters, framing actually decreases the average expenditure on punishment

(3.93 versus 11.7 in the partner groups). But this is less surprising in light of the observed higher

levels of contribution in the partner condition where reported average opinion about the fair

contribution served as group norm to follow. More intuitive is the difference in the punishment

levels between the random and the partner group composition treatments with no frame, 5.29

versus 11.7 (Wilcoxon-Mann-Whitney test, p=.0002). Presumably, subjects have an increased

incentive to punish other subjects with whom they are going to matched again. However, this

explanation is belied by the lack of decay in punishment expenditures over the course of the

treatment. Note that in the partner groups low-grid-low-group (selfish) individuals have the

incentives to punish others because they benefit from increased contributions in the next period.

While in the shuffled treatments, only high-grid individuals would be expected to punish others

at some cost to themselves. Therefore, in the partner matching with no frame we have higher

punishing expenditures because low-grid-low-groupness individuals also punish whereas in the shuffled groups only high-grid subjects attempt to enforce norms. This is why grid scores and punishment correlations become stronger and statistically significant in the shuffled groups with and without frame (.111 for shuffled groups with no frame compared to .012 for partner groups with no frame and .230 for shuffled groups with frame compared to .081 for partner groups with frame).

Result 6 *Punishment was targeted toward low contributors and subjects were punished if their contributions fall below the other's average. Yet, efficiencies with and without punishment were no different.*

Support:

Punishment: Simple regression analysis shows negative relationship between punishment points that subjects received from others and negative deviation from other's average contribution. See Table VI, Figure III. We run ordinary least square (OLS) regression of punishment points on constant, other's average contribution, absolute negative deviation, positive deviation and dummies for rounds and sessions in shuffled treatments, dummies for rounds and matched groups in partner treatments. In both shuffled and partner treatments the coefficient of the absolute negative deviation was highly significant and positive indicating that subjects were punished more the more their contribution fall below the other's average. The coefficient on positive deviation was insignificant and low which confirms absence of systematic antisocial, spiteful or revenge-type punishment. Among after-treatment responses on motives to punish others were to punish those who were (i) selfish, (i) not investing in the group exchange, and (iii) contributing way less than the average.

 Efficiency: We compute the efficiency as a percentage of actual surpluses reached during the experiments from the maximum surplus available with no punishment (in our case 400), where surplus is the sum of individual payoffs within the group. As we discussed above, with punishment opportunity contributions increased significantly as well as the payoffs compared to the no punishment VCM. At the same time, recall that punishment is a costly activity that reduces the payoffs for both the punisher and receiver. Wilcoxon matched-pairs signed-rank test suggests that in both shuffled conditions with and without frame average efficiency was no different between VCM with no punishment and VCM with punishment (p=.7989, p=.2026). To summarize, only in the partner condition with no frame we had efficiency drop from no punishment to punishment condition (p=.0051). This was due the fact that punishment was way too high in this treatment due to no framing plus selfish motive to punish others. This suggests that punishment institutions are efficiency improving if the cost of administering monitoring is low and the deadweight losses due to fines are low. In our ECM games efficiency maintains at the VCM level due to multiple fine structure up to the level where subject may lose all earnings.

5.3 Ultimatum Game Results

Now we report the results of two-person ultimatum game where subjects were paired once as a proposer and as a responder. Some of sessions had shuffled and some had partner pairing.

Result 7 *Predictive capability of grid/group variables are verified in regular version of ultimatum games. Namely, group scores were positively correlated with the average offers. Proposer's offers had a single dominant mode at fifty percent. The grid indicator was silent due to low number of rejections.*

Support:

Groupness and offers: Examination of initial bivariate correlations reveals a number of interesting and important findings. In Table II, respondents' group scores and initial offers (Offer) correlated in a strong and statistically significant manner in the direction expected by the theory in all four treatments. This direction and significance hold up for both the indexed and alt indicators of groupness, showing the strength of this finding in the partner conditions. Respondents indexed group scores in the partner conditions were positively correlated with the average amount they offered other subjects in the experiment (.272) and statistically significant at the 0.01 level; the alternative group question was also associated with respondent contributions in a positive (.327) and similarly statistically significant manner.

Gridness and acceptance: Respondent indexed and alt grid scores and acceptance of offers (Acceptance) were also correlated in the expected negative direction, although not statistically significant. One factor in particular may have led to the lack of statistical significance in the result; the first being the relatively generous average initial offers (itself a function of relatively high mean groupness in the population) meant that there were relatively few cases in which the norm of reciprocity called for rejection of an offer, leading to a small sample size.

Partner vs. stranger matching: If the grid and group attributes were more pronounced in the VCM shuffled games, in the ultimatum games correlations between group scores and offers were stronger for those subjects whose groups were not shuffled (.272) compared to those whose groups were shuffled (.223 and no longer significant). Mean offers in partner frame were higher than the mean offers in the shuffled frame condition (Wilcoxon rank-sum test, p=.0383). There was no significant framing effect in the ultimatum treatment. See Figures IVA to IVD.

6. Discussion

This paper examines the relationship between individual-level cultural characteristics (grid and group as measured by survey) and behavior in controlled computer-mediated experiments. Evidence from lab experiments provides a strong and systematic confirmation of a predictable role of grid and group in determining performance across different institutional settings. In particular, high-group individuals contribute more than low-grid individuals in VCM game. Moreover, with punishment opportunity high-grid individuals inclined to social norms and punish others more than low-grid individuals. The shuffled groups VCM allow capturing this heterogeneity in population. Punishment opportunity and availability of high-grid subjects (strong reciprocators) willing to establish norms by incurring monitoring cost lead to higher cooperation in ECM than the VCM. The threat of punishment substantially increases average contributions, yet efficiencies in both institutions (with and without punishment) were the same. This was due to monitoring costs to maintain institution and reduction in payoffs related to punishment. Furthermore, there was no evidence of antisocial punishment; punishment was more targeted to low-contributors than high-contributors. As a result, punishing expenditures were lower. Moreover, predictive power of grid/group attributes also verified in the ultimatum game. In particular, group attribute was positively correlated with offers in the regular ultimatum game. With low number of rejections the grid attribute was silent. Overall, this study shows that cultural factors can be used to predict individual and team performance in an environment of collective action and that this can be demonstrated using the contemporary tools of experimental social science. That being said, this should just be the beginning of the journey.

Reference

Ahn, Toh-Kyeong, Elinor Ostrom, David Schmidt, and James Walker, ``Trust in Two-person Games: Game Structures and Linkages,'' in *Trust and Reciprocity. Interdisciplinary Lessons From Experimental Research,* Elinor Ostrom and James Walker, ed. (New York: Russell Sage Foundation, 2003, pp. 323–351).

Alesina, Alberto and Eliana LaFerrara "Ethnic Diversity and Economic Performance," *Journal of Economic Literature,* September **2005**, 43: 721-61.

Andreoni, James, ``Cooperation in Public-Goods Experiments: Kindness or Confusion?'' *The American Economic Review,* 85 (4), (1995), 891-904.

Andreoni, James, Marco Castillo, and Ragan Petrie, ``What Do Bargainer's Preferences Look Like? Experiments with a Convex Ultimatum Game,'' *American Economic Review,* 93 (2003), 672-685.

Andreoni, James and John H Miller, 2001. Analyzing Choice with Revealed Preference: Is Altruism Rational, Levine's Working Paper Archive, UCLA Department of Economics.

Ashraf, Nava, Iris Bohnet, and Nikita Piankov, ``Decomposing trust and trustworthiness,'' *Experimental Economics,* 9 (2006), 193-208.

Bernhard Helen, Ernst Fehr, and Urs Fischbacher,2006. Group Affiliation and Altruistic Norm Enforcement. American Economic Review, 96: 217-221

Bolton, Garry E., and Axel Ockenfels, ``Erc: A Theory of Equity, Reciprocity and Competition,'' *The American Economic Review,* 90 (2000), 166-193.

Buchan Nancy R., and Rachel T.A. Croson 2004 The boundaries of trust: own and others' actions in the US and China. Journal of Economic Behavior and Organization, 55: 485-504

Buchan Nancy R., Eric J. Johnson and Rachel T.A. Croson 2005. Let's get personal: An international examination of the influence of communication, culture and social distance on other regarding preferences. Journal of Economic Behavior and Organization, article in press.

Carpenter, Jeffrey, Samuel Bowles, and Herbert Gintis, ``Mutual Monitoring in Teams: Theory and Experimental Evidence on the Importance of Reciprocity,'' IZA Discussion Papers 2106, Institute for the Study of Labor (IZA), 2007.

Capra, C. Mónica, Kelli Lanier, and Shireen Meer, ``Attitudinal and Behavioral measures of trust: a New Comparison,'' working paper, 2008.

Chai, Sun-Ki, *Choosing an Identity: A General Model of Preference and Belief Formation*. (Ann Arbor, MI: University of Michigan Press, 2001).

Chai, Sun-Ki, and Aaron Wildavsky, ``Culture, Rationality and Violence,'' in *Politics, Culture and Policy: Applications of Cultural Theory,* Dennis J. Coyle and Richard J. Ellis ed. (Boulder,

CO: Westview Press, 2004, 159-174). Reprinted in *Culture and Social Theory*, Chai and Swedlow, ed., 281-298.

Chai, Sun-Ki, and Brendon Swedlow, *Culture and Social Theory*. (New Brunswick, NJ: Transaction Publishers, 1998).

Charness, Gary, and Matthew Rabin. 2002. Understanding social preferences with simple tests. *Quarterly Journal of Economics* 117 (3): 817-69.

Charness, Gary, **Luca Rigotti and Aldo Rustichini**. 2007. "**Individual Behavior and Group Membership**." American Economic Review, 97: 1340-1352

Chen, Yan and Sherry Xin Li. ``**Group Identity and Social Preferences''** *American Economic Review* 99: 1 (March 2009): 431-457.

Chen, Yan, Sherry Li, Tracy Xiao Liu **and Margaret Shih**, 2008. Social Identity, Diversity and Stereotypes, working paper

Chhokar, Jagdeep S., and C. Brodbeck Felix, *Culture and Leadership Across The World: The GLOBE Book Of In-Depth Studies Of 25 Societies.* (New York: Lawrence Erlbaum, 2007).

Chuah, Swee-Hoon, Robert Hoffmann, Martin Jones and Geoffrey Williams. ``An economic anatomy of culture: Attitudes and behaviour in inter- and intra-national ultimatum game experiments.'' *Journal of Economic Psychology*, 30 (2009), 732–744.

Danielson, Anders J., and Hakan J. Holm, ``Do you trust your brethren? Eliciting trust attitudes and trust behavior in a Tanzanian congregation,'' *Journal of Economic Behavior & Organization,* 62 (2007), 255-271.

Douglas, Mary, ``Cultural Bias.'' in *The Active Voice*, M.Douglas ed. (London: Routledge and Keegan Paul, 1989).

Douglas, Mary, and Aaron Wildavsky, *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers.* (Berkeley: University of California Press, 1982).

Durkheim, Emile, *Suicide.* (New York: Free Press, 1897. Reissue edition. 1997).

Dufwenberg, Martin, and Georg Kirchsteiger, 1998. A Theory of Sequential Reciprocity, CentER Discussion paper No. 9837, Tilburg University.

Eckel, Catherine C., and Philip J. Grossman. 2005. Managing diversity by creating team identity. *Journal of Economic Behavior & Organization* 58: 371–392.

Falk, Armin, and Urs Fischbacher, ``A theory of reciprocity,'' *Games and Economic Behavior*, 54 (2006), 293-315.

Fehr, Ernst, and Simon Gachter, ``Cooperation and Punishment in Public Goods Experiments,'' *American Economic Review*, 90 (2000), 980-994.

Fehr, Ernst, and Simon Gachter, ``Reciprocity and Economics: The Economic Implications of Homo Reciprocans,'' *European Economic Review*, Elsevier, 42 (1998), 845-859.

Ernst Fehr & Klaus M. Schmidt, 1999. "**A Theory Of Fairness, Competition, And Cooperation**," The Quarterly Journal of Economics, 114(3), 817-868.

Fehr, Ernst, Urs Fischbacher, and Simon Gachter, ``Strong Reciprocity, Human Cooperation, and the Enforcement of Social Norms,'' *Human Nature,* 13 (2002), 1-25.

Fischbacher, Urs, Simon Gachter, and Ernst Fehr, ``Are People Conditionally Cooperative? Evidence from a Public Goods Experiment,'' *Economics Letters,* 71 (2001), 397-404.

Fischbacher, Urs, ``z-Tree: Zurich Toolbox for Ready-made Economic Experiments,'' *Experimental Economics*, 10 (2007), 171-178.

Gächter, Simon, Benedikt Herrmann, and Christian Thöni, ``Trust, Voluntary Cooperation, and Socio-Economic Background: Survey and Experimental Evidence,'' *Journal of Economic Behavior and Organization,* 55 (2004), 505-531.

Goette Lorenz, David Huffman, and Stephan Meier, 2006.The Impact of Group Membership on Cooperation and Norm Enforcement: Evidence Using Random Assignment to Real Social Groups. American Economic Review, 96: 212-216

Habyarimana, James, Macartan Humphreys, Daniel N. Posner, Jeremy M. Weinstein, 2007. Why Does Ethnic Diversity Undermine Public Goods Provision? American Political Science Review, 101(4): 709-725

Glaeser, Edward L., David I. Laibson, Jose A. Scheinkman, and Christine L. Soutter, ``Measuring trust,'' *Quarterly Journal of Economics*, 115 (2000), 811–846.

Guth, Werner, Rolf Schmittberger, and Bernd Schwarze, ``An Experimental analysis of ultimatum bargaining,'' *Journal of Economic Behavior and Organization,* 3 (1982), 367-388.

Hampden-Turner, Charles, and Alfons Trompenaars, *The Seven Cultures of Capitalism: Value Systems for Creating Wealth in the United States, Japan, Germany, France, Britain, Sweden, and the Netherlands.* (New York: Doubleday, 1993).

Henrich, Hoseph, Robert Boyd, Samuel Bowles, Colin Camerer, Ernst Fehr, Herbert Gintis, and Richard McElreath, ``In Search of Homo Economicus: Behavioral Experiments in 15 Small-Scale Societies,'' *American Economic Review,* 91 (2001), 73-78.

Henrich, Joseph, Robert Boyd, Samuel Bowles, and Colin Camerer, *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies.* (Cambridge: Cambridge University Press, 2004).

Hofstede, Geert, *Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations Across Nations.* (Los Angeles: Sage Publications. 2003).

House, Robert J., Paul J. Hanges, Mansour Javidan, and Peter Dorfman, *Culture, Leadership, and Organizations: The GLOBE Study of 62 Societies. (*Thousand Oaks: Sage Publications, Inc., 2004).

Inglehart, Ronald., Miguel Basanez, Jaime Diez-Medrano, Loek Halman, and Ruud Luijkx, *Human Beliefs and Values: A Cross-Cultural Sourcebook based on the 1999 2002 Values Surveys*. (Siglo XXI Editores: Mexico, 2004).

Rabin, Matthew, ``Incorporating Fairness into Game Theory and Economics,'' *American Economic Review,* 83 (1993): 1281-302.

Liebrand,W.B.G., 1984. The effect of social motives, communication and group sizes on behavior in an *n*-person multi stage mixed motive game. European Journal of Social Psychology 14, 239–264.

Ma, Leanne, Katerina Sherstyuk, Malcolm Dowling, Olivier Hill, 2002. Altruism and voluntary provision of public goods. Economics Bulletin*,* 3, 1−8.

Offerman, T., Sonnemans, J., Schram, A., 1996. Value orientations, expectations and voluntary contributions in public goods. Economic Journal 106, 817–845.

Sonnemans, J., Schram, A., Offerman, T., 1998. Public good provision and public bad prevention: the effect of framing. Journal of Economic Behavior and Organization 34, 143–161.

Stock, Ruth, ``Drivers of Team Performance: What Do We Know and What Have We Still to Learn?'' *Schmalenbach Business Review,* 56 (2004), 274 - 306.

Tanaka, Tomomi, Colin F. Camerer, and Quang Nguyen. 2010. "Risk and Time Preferences: Linking Experimental and Household Survey Data from Vietnam."*American Economic Review*, 100(1): 557–71.

Van Dijk, F., Sonnemans, J., van Winden, F., 2002. Social ties in a public good experiment. Journal of Public Economics 85, 275–299.

Weber, Roberto and Colin Camerer 2003 Cultural Conflict and Merger Failure: An Experimental Approach, *Management Science* 49 (4): 400-415.

Wildavsky, Aaron, ``Choosing Preferences by Constructing Institutions: A Cultural Theory of Preference Formation,'' *American Political Science Review,* 81 (1987), 3-21.

Yamagishi, Midori, and Toshio Yamagishi, ``The Provision of a Sanctioning System in the United States and Japan,'' *Social Psychology Quarterly,* 5 (1988), 265-71.

Table I: Summary of Experimental Sessions

	Number of periods	Number of groups in four persons	Date	Session code
Design1 :	NP, P, UG			
(NP $*$), (P $*$), (UG $*$)	10, 10, 2	3	2/5/08	1
	10, 10, 2	4	2/7/08	7
Design2 :				
(NP), (P), (UG)	10, 10, 2	4	2/5/08	2
	10, 10, 2	5	2/6/08	5
Design3 :				
(NP $-$ F $*$), (P $-$ F $*$), (UG-F$*$)	10, 10, 2	4	2/6/08	3
	10, 10, 2	3	2/7/08	6
Design4 :				
(NP $-$ F), (P $-$ F), (UG-F)	10, 10, 2	5	2/6/08	4
	10, 10, 2	5	2/7/08	8

NP-no punishment, P-punishment, $*$-partner (iterated) condition, F-framing, UG-ultimatum game

Table II. Pearson Correlations

		Shuffled Frame							Shuffled No Frame					Shuffle pool	
		Contrib	P Contrib	Punish	Norm	Pnorm	Offer	Accept	Contrib	P Contrib	Punish	Offer	Accept	Contrib	Offer
Grid	Pearson's r	-.036	-.102*	.230**	-.137**	-.309**	.1924	-.0523	-.107*	.093	.111*	.0505	.0556	-.0743*	.0987
	Sig. (2-tailed)	.477	.041	0	.006	0	.2344	.7487	.043	.079	.036	.7698	.7476	.0407	.3961
	N	400	400	400	400	400	40	40	360	360	360	36	36	760	76
Group	Pearson's r	.293**	.026	-.172**	.308**	-.005	.5147**	-.0012	.207**	.096	.048	-.008	.196	.2531*	.2234
	Sig. (2-tailed)	0	.584	.001	0	.922	.0007	.9942	0	.068	.369	.9632	.252	0	.0524
	N	400	400	400	400	400	40	40	360	360	360	36	36	760	76
Alt Grid	Pearson's r	-.019	-.175**	-.062	-.045	-.421**	.1589	.0052	-.176**	-.248**	.027	-.228	-.0744	-.0917*	-.0531
	Sig. (2-tailed)	.708	0	.216	.365	0	.3274	.9746	.001	0	.612	.1811	.6661	.0114	.6489
	N	400	400	400	400	400	40	40	360	360	360	36	36	760	76
Alt Group	Pearson's r	.032	-.089	.004	.171*	-.241**	.2495	.015	.198**	.269**	.047	.1425	.255	.1002*	.1803
	Sig. (2-tailed)	.525	.075	.939	.001	0	.1205	.9267	.001	0	.374	.407	.1334	.0057	.119
	N	400	400	400	400	400	40	40	360	360	360	36	36	760	76

		Partner Frame							Partner No Frame					Partner pool
		Contrib	P Contrib	Punish	Norm	Pnorm	Offer	Accept	Contrib	P Contrib	Punish	Offer	Accept	Offer
Grid	Pearson's r	.198**	.008	.081	.103	.0928	-.0036	.0377	.191**	-.113	.012	-.0168	-.263	-0.0122
	Sig. (2-tailed)	.001	.889	.179	.085	.1214	.9853	.8488	.001	.06	.839	.9323	.1763	0.9288
	N	280	280	280	280	280	28	28	280	280	280	28	28	56
Group	Pearson's r	.227**	.1639**	-.006	.170**	-.0113	.1857	.125	.156**	.1646*	-.236**	.3521	-.1104	.2715*
	Sig. (2-tailed)	.0001	.006	.925	.004	.8503	.3442	.5263	.009	.006	0	.0662	.576	.043
	N	280	280	280	280	280	28	28	280	280	280	28	28	56
Alt Grid	Pearson's r	.182**	.168**	.074	.185**	.2184**	-.1379	.5471*	.253*	.07	-.06	-.1206	-.1082	-.1487
	Sig. (2-tailed)	.0022	.0048	.2168	.002	.0002	.4842	.0026	0	.247	.32	.5411	.5836	.2741
	N	280	280	280	280	280	28	28	280	280	280	28	28	56
Alt Group	Pearson's r	.476**	.2547**	-.072	.1219*	.2751**	.1867	.0804	-.091	.0486	-.0557	.4481*	-.1843	.3274*
	Sig. (2-tailed)	0	0	.2294	.042	0	.3414	.6844	.1304	.4179	.3534	.0168	.3477	.0138
	N	280	280	280	280	280	28	28	280	280	280	28	28	56

Table III. VCM without Punishment

period	Partner				Shuffled			
	Frame	sd	No Frame	sd	Frame	sd	No Frame	sd
1	32.07	(18.24)	33.32	(16.49)	28.83	(15.62)	27.56	(17.27)
2	33.36	(17.70)	30.82	(17.60)	25.4	(17.07)	23.89	(18.34)
3	32.79	(19.93)	32.11	(15.92)	24.67	(16.16)	24.47	(17.32)
4	33.11	(19.85)	33.11	(16.98)	22.52	(17.32)	24.11	(16.78)
5	31.25	(21.33)	30.04	(18.30)	22.08	(17.77)	19.08	(18.87)
6	31.54	(21.11)	30.82	(17.53)	19.9	(17.54)	21.03	(17.06)
7	29.79	(22.52)	37	(14.25)	21.02	(17.07)	19.64	(17.56)
8	29.29	(22.96)	28.75	(19.20)	19.63	(17.06)	21.89	(17.79)
9	25.64	(23.11)	23.46	(20.51)	16.88	(17.91)	16.22	(16.63)
10	21.04	(21.74)	22.29	(18.88)	14.6	(18.15)	17.42	(17.53)
mean	**29.99**		**30.17**		**21.55**		**21.53**	

	partner	shuffled
Ho:		
p-value*: Frame=No Frame	.9698	.8798
p-value*: time1=time5	.6623	.0153
p-value*: time1=time10	.0179	.0003
p-value*: time5=time10	.0805	.1609

p-value*: PartnerFrame=ShuffleFrame	.0009
p-value*: PartnerNoFrame=ShuffleNoFrame	.0015

* Wilcoxon Mann Whitney (rank-sum test)

time1 means group average contributions in period 1

sd-standard deviation

Table IV. Mean contributions and punishment in VCM with Punishment (ECM)

Round	Partner				Shuffled			
	Frame		No Frame		Frame		No Frame	
1	45.89	(9.74)	35.36	(14.19)	38.35	(11.75)	33.69	(14.31)
punish	3.04	(3.93)	8.93	(16.80)	6.13	(8.66)	5.97	(8.44)
2	46.71	(9.59)	35.07	(14.76)	38.05	(12.82)	34.17	(15.43)
punish	6.07	(14.80)	12.68	(19.08)	6	(10.87)	5.97	(9.77)
3	45.89	(9.82)	41.07	(11.17)	39.53	(11.66)	36.19	(14.54)
punish	3.93	(9.27)	10	(26.53)	6.5	(12.15)	4.17	(5.92)
4	47.21	(4.83)	36.61	(15.45)	39.53	(12.49)	34.78	(14.89)
punish	5.89	(22.69)	9.46	(15.17)	8.63	(14.50)	6.25	(12.09)
5	47.11	(5.95)	37	(15.49)	40.72	(10.76)	35.5	(16.03)
punish	2.32	(5.69)	12.86	(21.83)	7.63	(11.38)	5.14	(7.70)
6	47.71	(3.51)	35.96	(16.05)	42.38	(10.67)	34.94	(15.96)
punish	2.68	(8.11)	10	(20.00)	4.38	(8.71)	5.56	(10.40)
7	45.21	(12.15)	35.11	(16.17)	42.5	(9.49)	37.89	(14.74)
punish	2.68	(6.16)	12.32	(27.16)	3.25	(4.88)	4.17	(7.97)
8	43.04	(15.31)	36.21	(14.37)	43.58	(6.86)	36.08	(15.76)
punish	5	(11.86)	10.36	(26.77)	3.88	(6.65)	4.31	(7.19)
9	43.39	(13.90)	38.11	(14.14)	43.28	(7.37)	36.75	(15.90)
punish	3.57	(8.37)	10.89	(30.06)	3.25	(6.05)	5.56	(10.27)
10	41.75	(15.55)	39.14	(13.83)	42.17	(11.76)	36.86	(15.36)
punish	4.11	(9.63)	19.46	(36.42)	4	(7.27)	5.83	(17.79)
Mean Contribution	45.39		36.96		41.01		35.69	
Mean Punish	3.93		11.7		5.37		5.29	

	contribute	punish
p-value*: PartnerFrame=PartnerNo Frame	.0002	.0002
p-value*: ShuffleFrame=ShuffleNoFrame	.0002	.9397
p-value*: PartnerFrame=ShuffleFrame	.0015	.0586
p-value*: PartnerNoFrame=ShuffleNoFrame	.1306	.0002

* Wilcoxon Mann Whitney (rank-sum test)

sd-standard deviation

Contributions and punishment are no different across periods in the punishment condition
Contributions are higher with frame in both partner and shuffled condition
Punishment is higher with No Frame in partner condition, but no different in shuffled condition
Contributions are higher in partner condition with frame rather in shuffled with frame
Punishment is higher in partner conditions

Table V. Mean contributions and punishment in VCM by treatment

Treatment	Actual Mean Contributions		Actual Mean Punishment		contribute p-value*:	efficiency p-value*:
	Partner	Shuffle	Partner	Shuffle		
					VCM-Pa=ECM-Pa	
VCM	**30.17**	**21.53**	~	~	.0069	.0051
	(17.87)	(17.63)			VCM-S=ECM-S	
ECM	**36.97**	**35.69**	**11.7**	**5.29**	.0051	.7989
	(14.51)	(15.16)	(24.55)	(10.16)	VCM-F-Pa=ECM-F-Pa	
VCM-F	**29.99**	**21.55**	~	~	.0051	.0593
	(20.92)	(17.44)			VCM-F-S=ECM-F-S	
ECM-F	**45.4**	**41.01**	**3.93**	**5.37**	.0051	.2026
	(10.82)	(10.80)	(11.18)	(9.62)		

* Wilxocon matched-pairs signed-ranks test, two-tailed
ECM-voluntary contribution mechanism with punishment opportunity,
F-frame, Pa-partner, S-shuffle
Here punishment expenditure is used as measure of punishing behavior

Table VI Regression: determinants of getting punished

Independent variables	Dependent variable: received punishment points					
	Shuffled		Partner Frame		Partner No Frame	
Constant	0.349		-0.7484		-1.88	
	(0.43)		(2.27)		(1.77)	
Other's average contribution	-0.0102		0.01665		0.0483	
	(0.01)		(0.04)		(0.03)	
Absolute negative deviation	0.1111	***	0.09167	***	0.1188	***
	(0.01)		(0.01)		(0.02)	
Positive deviation	-0.0133		0.02602		0.04839	
	(0.01)		(0.04)		(0.04)	
	N= 760		N= 280		N= 280	
					F(18, 261)	
	F(15, 744) =34.99***		F(18, 261) =7.47***		=11.82***	
	Adj R-squared=0.40		Adjusted R^2= 0.30		Adjusted R^2= 0.41	
	DW=1.99		DW=1.75		DW=1.67	

Note: Standard errors are in parenthesis. *-significant at 10-percent,
 -significant at 5-percent,*-significant at 1-percent level
Regression includes dummies for rounds and sessions in shuffle treatments
and dummies for periods and groups in partner treatments

Since punishment level in the shuffled frame and shuffled no frame conditions were no different, we may pool shuffled data with and without frame

Figure 1a. Mean contributions by gridness, shuffled condition
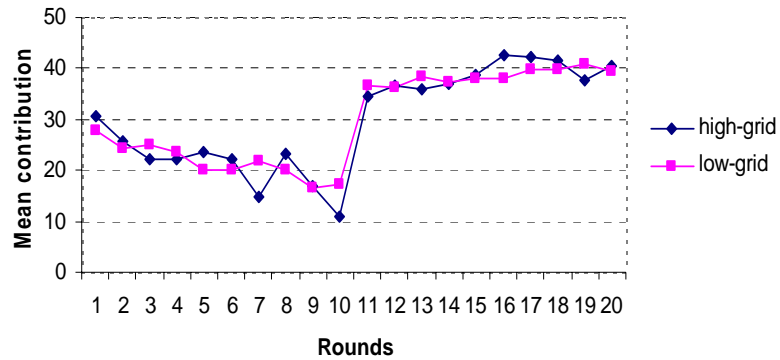
Figure 1b. Mean contributions by groupness, shuffled condition
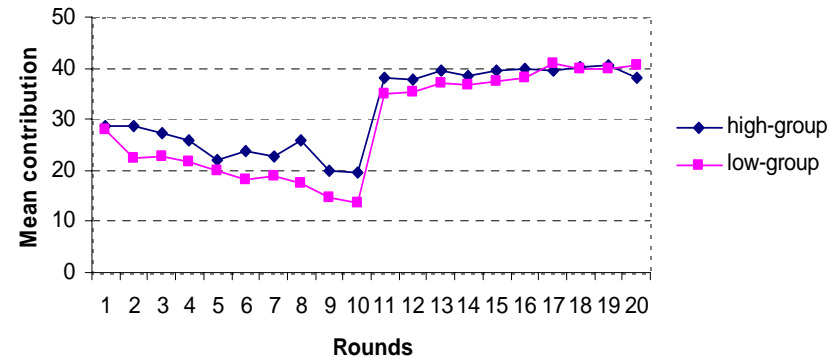
Figure 1c. Mean contributions by gridness, partner condition
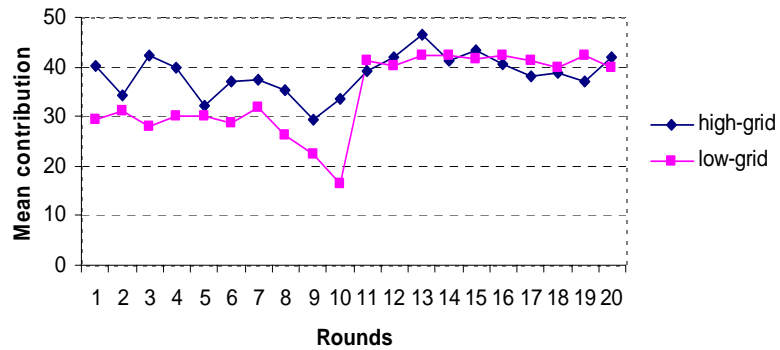
Figure 1d. Mean contributions by groupness, partner condition
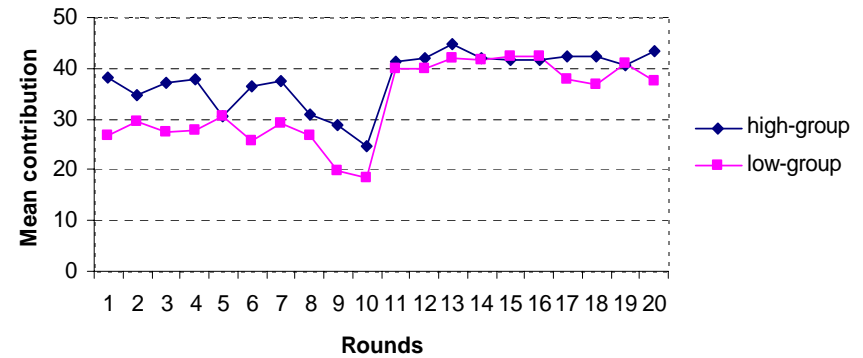
High-grid means grid score above 0.5, low-grid refers to grid score at or below 0.5. High-group refers to group score above 0.5, and low group refers to group score at or below 0.5.

Figure II. Mean Individual Contributions in VCM (1st ten periods) vs. ECM (last ten periods)

Figure III. Received Punishment Points
by deviation from the average contribution of the other group members
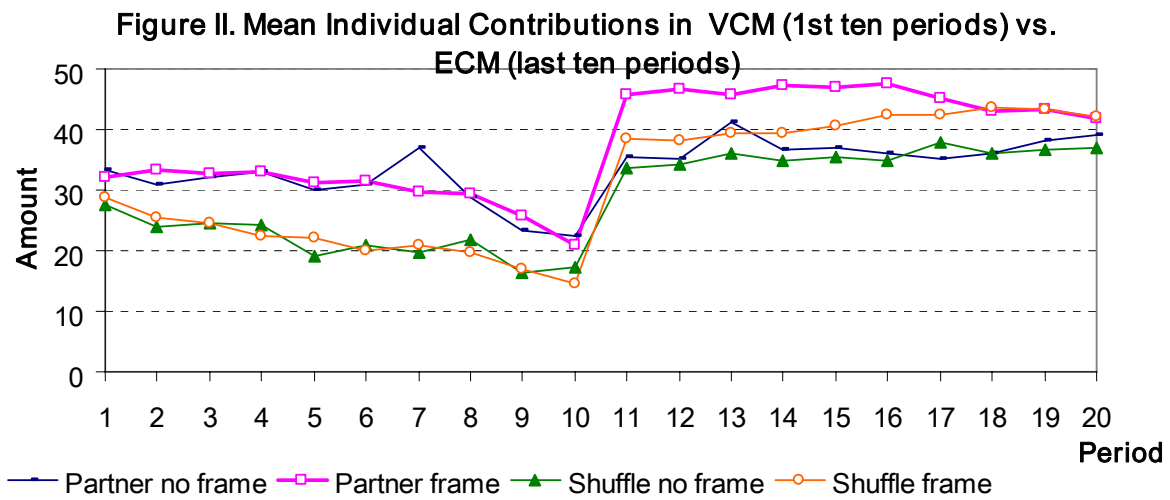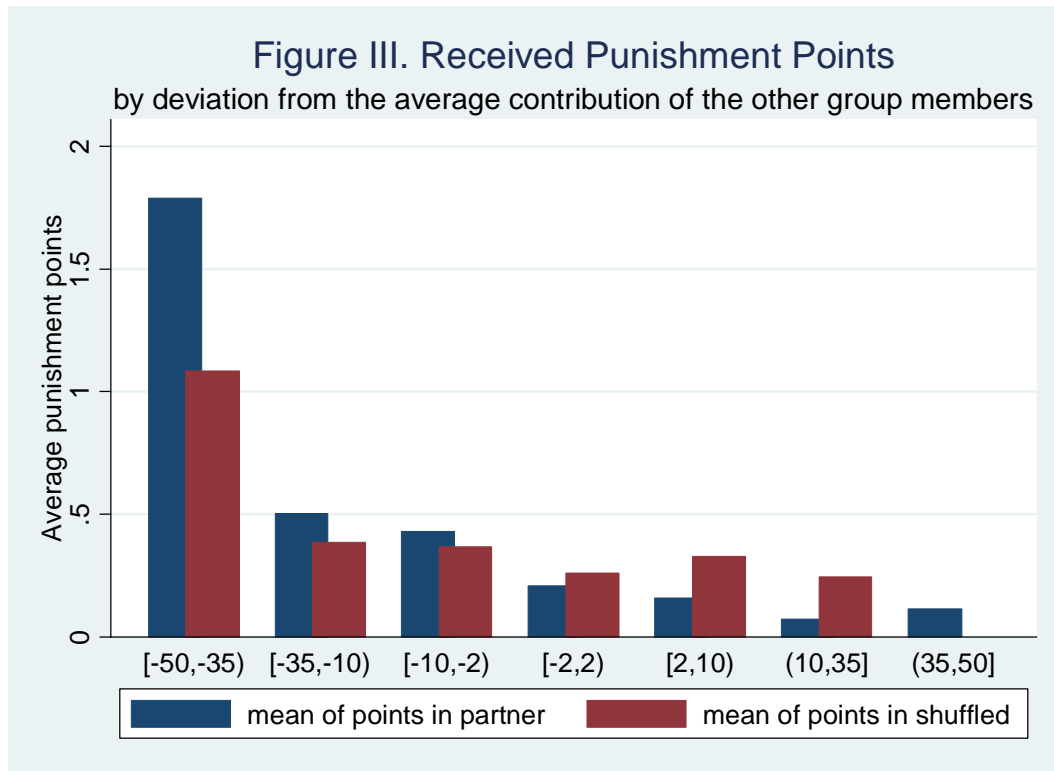
Figure IVA. Ultimatum game offers, $: Partner no frame
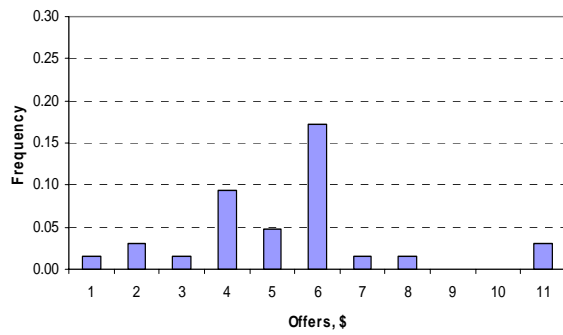
Figure IVB. Ultimatum game offers, $: Shuffle No Frame
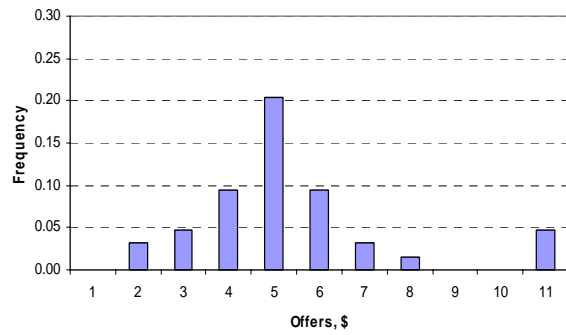
Figure IVC. Ultimatum game offers, $: Partner frame
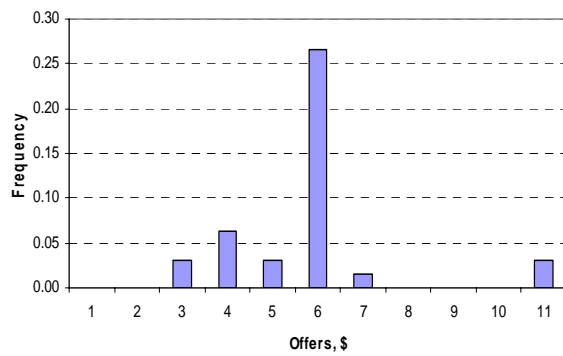
Figure IVD. Ultimatum game offers, $: Shuffle Frame
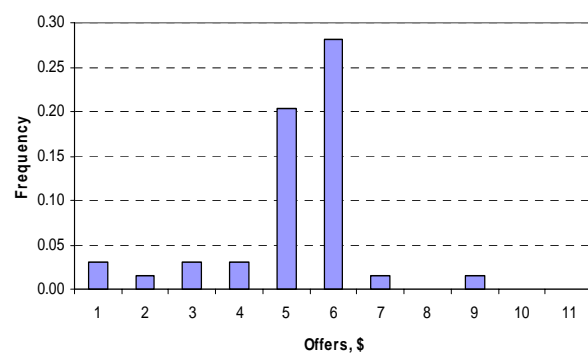
Supplementary material:
Appendix A

INSTRUCTIONS_1_U   */*for the VCM shuffled condition*/*

This experiment is a study of group and individual investment behavior. The instructions are simple and if you follow the instructions carefully and make good decisions you may earn a considerable amount of money. Your earnings and $5 participation fee will be paid in CASH in private at the end of the experiment. You are NOT allowed to communicate with any other participant. From this point onwards, you will be referred to by your participant number. Your ID number will appear at the left top corner of the screen.

GROUP

You will be in a group consisting of four players. The other players in your group will be actual people sitting in this room, but you will not be told which people you are interacting with.

INVESTING

The experiment will last for a several periods. The people in each group will be *varied at random* over the experiment, and therefore will change from period to period. You will be with a different group of people from period to period, though you will not be told who they are.

At the beginning of each period you will each be given 50 tokens in virtual money. Each token is worth 1 cent. These tokens are then invested to possibly earn cash. You will choose how to divide your tokens between two investment opportunities: Group Exchange and Individual Exchange.

GROUP EXCHANGE

Group Exchange is like a pooled investment of money by members of the group in a common project. What you earn from Group Exchange will depend on the TOTAL NUMBER OF TOKENS that you and the other three members of your group invest in the Group Exchange. The more the GROUP invests in Group Exchange, the more EACH MEMBER OF THE GROUP earns. Each of the four members will earn cash equivalent to HALF the total amount of tokens that are invested in the common project, regardless of who put in the tokens.   Adding the payoffs of the four group members up, together they will therefore earn cash from Group Exchange equivalent to TWICE the number of tokens that were put in. IT DOES NOT MATTER WHO INVESTS TOKENS IN THE GROUP EXCHANGE. EVERYONE WILL GET A RETURN FROM EVERY TOKEN INVESTED— WHETHER THEY INVEST IN THE GROUP EXCHANGE OR NOT.

INDIVIDUAL EXCHANGE

Every token you invest in Individual Exchange will earn you a return identical to what you put in, and NOBODY ELSE in the group will gain anything from your investment.

The process of investing in group and individual exchange is best explained by a number of examples:

Example: Suppose that everyone in a group decides to invest no tokens in group exchange and 50 tokens in individual exchange. Then each member of the group will get a payoff of 50 tokens.

Example: Suppose that everyone in a group decides to invest 50 tokens in group exchange and no tokens in individual exchange. Then there is a total of 200 tokens invested in group exchange, so each member of the group will get a payoff of 100 tokens.

Example: Suppose that you decided to invest no tokens in Group Exchange, but that the three other members each invested 50 tokens. This makes a total of 150 tokens in Group Exchange. Then your (and the other group members') earnings from the Group Exchange would each be 75 cents, despite the fact you did not invest anything. Because you invested no money in Group Exchange, you can invest 50 tokens in Individual Exchange for a return of 50 tokens. So your total earnings would be 125 tokens, as opposed to 75 tokens for other group members.

Example: Suppose that you decided to invest 50 tokens in Group Exchange, but that the three other members invested nothing. Then you and everyone else in the group would get a return from Group Exchange of 25 tokens. However, the other three members would also get 50 cents from Individual Exchange, while you get nothing. So the total earnings for the others would be 75 tokens, as opposed to 25 tokens earned by you.

Example: Suppose that you decided to invest 40 tokens in Group Exchange, and the three other members together invested a total of 40 tokens. This makes a total of 80 tokens. Then everyone's earnings from Group Exchange would be 40 tokens, and your total earnings would be 40 + 10 = 50 tokens.

THE INVESTMENT DECISION

Your task is to decide how many of your tokens to invest in Group Exchange, and how many to invest in Individual Exchange. You must invest your tokens in one kind of exchange or another, but the amounts are up to you. Remember that, for each round, you will be playing with a different group of three people from the previous round, determined at random, and you will not be told who they are. Your decisions in a particular round will therefore be unlikely to have any direct effect on your partners from the previous round.

STAGES OF INVESTMENT: There will be ten decision rounds in which you will be asked to make investment decisions. Your earnings in a decision period are the sum of the returns from the tokens you placed in each kind of exchange.

At the beginning of each round, you will be given an Endowment of 50 tokens. You simply enter the number of tokens you want to place in the Group Exchange. The number of tokens in the Individual Exchange will automatically be entered so that the sum of your investments equals your endowment, 50 tokens. The other players in your group will also have 50 tokens to invest. You must make your investment decisions WITHOUT knowing what the other players in your group are deciding.

You are not to reveal your investment decision to anyone. When you have made your investment decisions, you will click on the red "OK" button.

After each period, you will be shown the results including the total investment in Group Exchange, your total payoff, payoff from each kind of exchange and you will see how much each participant in your group invested in GROUP exchange. However, as mentioned the experiment is designed so that the real identity of any participant in a group is hidden, both to outsiders and to other participants.

The investment decision will continue for ten periods. Your earnings for each period will be added to determine your cumulative earnings.

If you have any questions concerning the instructions feel free to raise your hand and an instructor will assist you.

Please, go through the review question and fill in the blank lines with the values you think are correct.

PRACTICE ID _____

REVIEW

Consider the following investment decisions:

Person#	1	2	3	4	*Total Tokens in the Group Exchange*
decision: Individual Exchange	5	5	10	0	
Group Exchange	45	45	40	50	180

Suppose you are person #1. To compute your earnings, take the number of tokens in group exchange, which is 180 and multiply it by 0.5 (or divide by 2) to get 90 cents. Add to this value the return from your individual exchange which is 5 cents=5 tokens*1 cent and 95 cents=5+90 is your payoff.

Now, you go on and fill in the blank lines for ID#**3** and ID#**4**.

ID#3 earns:...

ID#4 earns:..…

Consider the following investment decisions:

Person#	1	2	3	4	*Total Tokens in the Group Exchange*
decision: Individual Exchange	50	50	10	50	
Group Exchange	0	0	40	0	40

Suppose you are person #1. To compute your earnings, take the number of tokens in group exchange, which is 40 and multiply it by 0.5 (or divide by 2) to get 20 cents. Add to this value the return from your individual exchange which is 50 cents=50 tokens*1 cent and 70 cents=50+20 is your payoff.

Now, you go on and fill in the blank lines for ID#**3** and ID#**4**.

ID#3 earns:...

ID#4 earns: ....

Please, raise your hand if you have any questions and an instructor will assist you.

At the beginning we will run a practice-period experiment to get familiar with the rules. It will NOT count towards your earnings.
ARE THERE ANY QUESTIONS?

Instructions_2_U   */*for the ECM shuffled condition*/*
We will now repeat this experiment with one change. As before, the experiment consists of ten periods and in each period you have to make a decision about how many of the 50 tokens at your disposal you want to invest to GROUP exchange (and, implicitly, how many you keep for INDIVIDUAL exchange).
      In each period the participants are divided into groups of four. You will therefore be in a group with 3 other participants. The composition of the groups will continue to vary at random. **Therefore, in each period your group will almost certainly consist of different members**.

The change
In each period the experiment consists of **two stages:**
      The first stage is identical to the previous part. Your return in the first stage will be calculated exactly as before. At the first stage you have to decide how many tokens you would like to invest in INDIVIDUAL or GROUP exchange.
      At the second stage you are informed of the investments of the three other group members to GROUP exchange. You can then decide whether or how much to reduce their earnings from the first stage by distributing penalty points to them.

The following pages describe the course of the experiment in detail:

The first stage
At the beginning of each period each participant receives 50 tokens. In the following paragraphs we call this his or her endowment.

The task in the first stage
Your task is to decide how to use your endowment. You have to decide how many of the 50 tokens you want to invest to INDIVIDUAL exchange and how many of them to keep in GROUP exchange.
      After all members of your group have made their decision, the screen will show you the total amount of investments by all four group members in GROUP exchange (including your investment). This screen also shows you how much you have earned at the first stage.

The Second Stage
In the second stage, you will see how much each of the other group members invested in GROUP exchange. After seeing this, you can **reduce or leave equal** the earnings of **each**

group member by **assigning penalty points**. The other group members can also reduce **your** earnings if they wish to.

The task in the second stage

You must now decide how many penalty points to assign to each of the other three group members. Each point you assign to a group member will reduce that person's earnings **for that period** by 10% of what they made in the first stage. You must enter a number between 0 and 10 for each group member, corresponding to amount you wish to reduce that member's earnings. You are not required to assign penalty points if you do not want. If you do not wish to change the earning of a specific group member then you can enter 0.

Assigning penalty points will cost you some of your own earnings. The more points you assign to any group member, the higher your cost. Your total costs are equal to the sum of the costs of assigning points to each of the other three group members. The following table illustrates the relation between assigning points to group members and the costs of doing so in tokens.

Points	0	1	2	3	4	5	6	7	8	9	10
Cost	0	5	10	15	20	25	30	35	40	45	50

If you choose 0 points for a particular group member, you do not change her or his earnings. However, if you assign a member 1 point (by choosing 1) you reduce his or her earnings from the first stage of the current period by 10%. If you assign a member 2 points (by choosing 2) you reduce his or her earnings from the first stage of the current period by 20%, etc. The amount of points you distribute to each member therefore determines how much you reduce their earnings. Your total costs of assigning penalty points are displayed on the input screen. As long as you have not pressed the O.K. button you can revise your decision.

The total reduction of a group member's earnings depends on the total number of penalty points assigned to him or her by the other members of the group. If somebody receives a total of 2 points from one member, 1 point from another, and 0 points from the last member her or his earnings for that period will reduced by 2+1+0=3 points, or 30%. If anybody receives a total of **10 or more** points their earnings for that period will be reduced by 100% of the amount earned in the first stage of the current period.

Your total earnings from the two stages is therefore calculated as follows:

Total earnings at the end of the 2nd stage = period earnings =

= (earnings from the 1st stage)*(10 - received points)/10 - costs of assigning points   if received points < 10

= - costs of assigning points   if received points >= 10

Example: Suppose you earn 75 tokens in the first stage of the current period, but are assigned a total of 2 penalty points by other members of your group in the second stage. Then your earnings are reduced by 20%, to 60 tokens. Suppose you have assigned 3 penalty points to one member, thus reducing the member's earnings for the current period by 30% of the amount they made in the first stage. This costs you 15 tokens. If you assign 2 points to another member this costs you a further 10 tokens, and if you assign the last group member 0 points this has no cost for you. In this case your total cost of assigning penalty points would be 25 tokens (10+15+0), and your total earnings would be reduced further by that amount, to 35 tokens.

Please note that your earnings at the end of the second stage can be negative if the costs of your points distributed exceeds your (possibly reduced) earnings from the first stage. **You can, however, evade such losses with certainty through your own decisions**!

After all participants have made their decision, your screen will inform you of your return from the first stage, the percentage lost due to received penalty points, the cost of assigning penalty points to others, and your final earnings from the period. **Even if you receive penalty points, you will not be told who assigned them to you.** Your earnings for all periods will be added to determine your period earnings and total earnings.

You are not to reveal your investment decision or ID to anyone. You must make your investment decisions WITHOUT knowing what the other players in your group are deciding. The actual identifies of team members will not be revealed by the computer program. **Because group members vary randomly from period to period, someone who was in your group in the current period will most likely not be in your group in the next period.**

If you have any questions concerning the instructions feel free to raise your hand and an instructor will assist you.

Please go through the review questions and fill in the blank lines with the values you think are correct.

PRACTICE ID _____

REVIEW

Consider the following situations:

1. Each group member has an endowment of 50 tokens. Nobody (including yourself) invests into GROUP account at the first stage. How high are:
Your earnings from the first stage?..........
The earnings of the other group members from the first stage?...........

2. Each group member has an endowment of 50 tokens. You invest 50 tokens to the GROUP exchange at the first stage. All other group members each invest 50 tokens to the GROUP project at the first stage. What are:
Your earnings from the first stage?..........
The earnings of the other group members from the first stage?...........

3. Each group member has an endowment of 50 tokens. The other three group members invest together a total of 30 tokens to the GROUP exchange.
a) What are your earnings from the first stage if you invest a further 0 tokens to the GROUP exchange?...........
b) What are your earnings from the first stage if you invest a further 16 tokens to the GROUP exchange?...........

4. Each group member has an endowment of 50 tokens. You invest 25 to the GROUP exchange.
a) What is your earnings from the first stage if the other group members together invest a further total of 7 tokens to the GROUP project?..........
b) What is your earnings from the stage if the other group members together invest a further total of 23 cents to GROUP project?..........

5. At the second stage you distribute the following points to your three other group members: 9,5,0. What are the total costs of your distributed points?..........

6. What are your costs if you distribute a total of 0 points?...........

7. By how many % will your earnings from the first stage be reduced, when you receive a total of 0 points from the other group members?...........

8. By how many % will your earnings from the first stage be reduced, when you receive a total of 4 points from the other group members?...........

9. By how many % will your earnings from the first stage be reduced, when you receive a total of 15 points from the other group members?...........

At the beginning we will run a practice-period experiment to get familiar with the rules. It will NOT count towards your earnings.

Instructions_3   */*the ultimatum game, stranger condition*/*

The Task

In this experiment, each person in the experiment will be making a series of two decisions. In the first stage of the experiment, you will be in the role of the Proposer. You will be provided a sum of money and you will be matched **anonymously** and **randomly** with another individual in the room, a Responder. You will be asked how much of the money you want to offer to this individual.

In the second stage, the responder to whom you sent the offer will decide whether to accept or reject your offer.

If the Responder **accepts** the number that you send, you will keep the remaining dollars for yourself.

If the Responder **rejects** the number you send, both you and the Responder receive ZERO dollars.

While the Responder is making his or her decision, you will also be placed in the role of a Responder and will be asked to make the same decision about an offer from another subject who was in the role of Proposer in the first stage. Very Important: The offer you receive will come from a different person than the person to whom you sent your offer in the first stage.

Everyone in the experiment is making an offer to another person in the first stage and responding to the offer of yet another person in the second stage. When the second stage is complete, you will be told whether or not your offer was accepted or rejected and see your total earnings for both decisions.

PROPOSER

You are the **Proposer** and you are given 10 dollars. Your task as the Proposer is to decide on a division of the 10 dollars between the Proposer and the Responder by sending some amount of dollars to the Responder and keeping the rest. The Proposer can only send whole dollars: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, up to 10, but **not** a value like 5.21.

With this 10 dollars available, if you send 2 dollars to the Responder and the Responder **accepts** this number, you would keep 8 dollars. If the Responder **rejects** this number, you and the Responder will receive **ZERO** dollars.

If you sent 8 dollars to the Responder and the Responder **accepts** this number, you would keep 2 dollars. If the Responder **rejects** this number, you and the Responder will receive **ZERO** dollars.

RESPONDER

If you are the **Responder,** your task is to choose whether to accept or reject the dollars sent by the Proposer. If you **accept**, you will receive the number of dollars the Proposer has sent to you.

If you **reject** the number of dollars sent to you by the Proposer, both you and the Proposer receive ZERO dollars.

With 10 dollars available, if the Proposer sends you 8 dollars and you accept this number, you receive 8 dollars and the Proposer keeps 2 dollars. If you reject this number, both you and the Proposer receive ZERO. If the Proposer sends you 2 dollars and you accept this number, you receive 2 dollars and the Proposer keeps 8 dollars. If you reject this number, both you and the Proposer receive ZERO dollars.

If you have any questions concerning the instructions feel free to raise your hand and an instructor will assist you.

Please, go through the review question and fill in the blank lines with the values you think are correct.

PRACTICE ID _____

REVIEW

Consider the following situations where Proposer has $10 to divide:

Please calculate the earnings for both of these roles using specific examples. After you finish, raise your hand and one of us will come by your desk and check your answers.

(1) If you are the **Proposer** and you send $3 to the Responder and the Responder **accepts** this number, then you get $_____ and the Responder gets $_____.
(2) If you are the **Proposer** and you send $3 to the Responder and the Responder **rejects** this
number, then you get $_____ and the Responder gets $_____.
(3) If you are the **Responder** and the Proposer sends $4 to you and **you accept** this
number, then you get $_____ and the Proposer gets $_____.
(4) If you are the **Responder** and the Proposer sends $4 to you and **you reject** this
number,
then you get $_____ and the Proposer gets $_____.

Grid-Group Cm-alpha, Profiling Cultural Factors for Decision Aiding

Grid/group cultural theory and behavior in voluntary contributions public goods experiments

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November 14, 2008

Statement of problem and motivation

- <u>Conventional economic theory can't explain cooperation in PG game:</u>
  Evidence on cooperation: 40-60% of endowment devoted to PG declining to 10-15% toward the end

- <u>Theories of other-regarding preferences:</u>
  -Andreoni 1995, Andreoni & Miller 2001 altruism
  -Bolton & Ockenfels 2000, Fehr & Schmidt 1999 inequity aversion
  -Rabin 1993, Dufwenberg & Kirchsteiger 1998, Falk & Fischbacher 1998, Gintis 2000 reciprocity
  -Casari and Plott 2003, spiteful , selfish, & altruist

- <u>Theories from other social sciences that incorporates culture:</u>
  Grid/group model (Douglas 1980, Douglas and Aaron Wildavsky 1982, Chai and Wildavsky 1994):
  Grid- the degree to which individuals' choices are circumscribed by their position in society;
  Group- the degree of solidarity among members of the society;
  -high-group individuals have altruistic preferences; high-grid individuals have reciprocal preferences; low-grid-low-group individuals have self-regarding preferences;

Research Questions

Study the effect of cultural attributes on group behavior in VCM games:

- H1: High-group individuals will contribute more in the VCM than low-group individuals

- H2: In the punishment VCM high-grid individuals will be more likely to punish others than low-grid individuals, especially in the shuffled treatments

- H3: Threat of punishment will increase contributions among cultural types

Method

- Computer-mediated experiments involving 132 students from University of Hawaii at Manoa
- Grid/group attributes measured through pre-test survey containing selected questions from World Value Survey
- 2 basic treatments in four designs:
  (i) VCM, (ii) punishment VCM, 10 rounds each;

design 1: partner, no frame

design 2: shuffled, no frame

design 3: partner, frame (average group opinion about fair contribution obtained through survey reported during the treatment)

design 4: shuffled, frame

- VCM set up: N=4, e=50, MPCR=0.5
- VCM with punishment set up: 2 stages: (i) contribution (ii) assigning points (Fehr & Gachter 2000);
  *1 point assigned to others costs to punisher 5 cents
  *1 point received from others reduces the payoff by 10 percent

- Questionnaire about strategies after the treatments

Experiment design and predictions

Treatment	High-Groupness	High-Gridness
VCM, No Punishment	Contribute more	
VCM with Punishment		Punish more others

- Partner treatment has finitely repeated nature
- Shuffled treatment has one-short game structure

Voluntary Contributions Mechanism Correlations

		Shuffled			Partner		
		Contribution Level No Punishment	Contribution with Punishment	Punishment Expenditure	Contribution Level No Punishment	Contribution with Punishment	Punishment Expenditure
Grid	Pearson correlation	-0.100	0.038	0.263***	0.261*	-0.075	0.056
	Sig. (2-tailed)	0.392	0.748	0.022	0.052	0.582	0.683
Group	Pearson correlation	.350***	0.096	-0.116	0.251*	0.171	-0.218
	Sig. (2-tailed)	0.002	0.411	0.318	0.062	0.208	0.106
	N	76	76	76	56	56	56

*** Correlation is significant at the 0.01 level (2-tailed).

** Correlation is significant at the 0.05 level (2-tailed).

* Correlation is significant at the 0.10 level (2-tailed).

Mean Individual Contributions

Figure 1a. Mean of Individual Contributions over time, Partner (pooled)
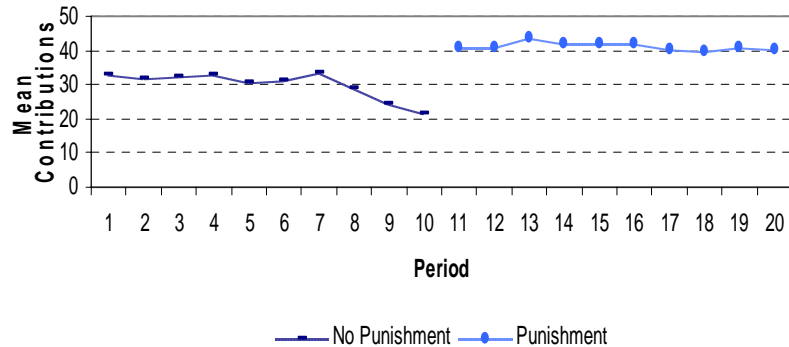
Figure 1b. Mean Individual Contribution over time, Shuffle (pooled)
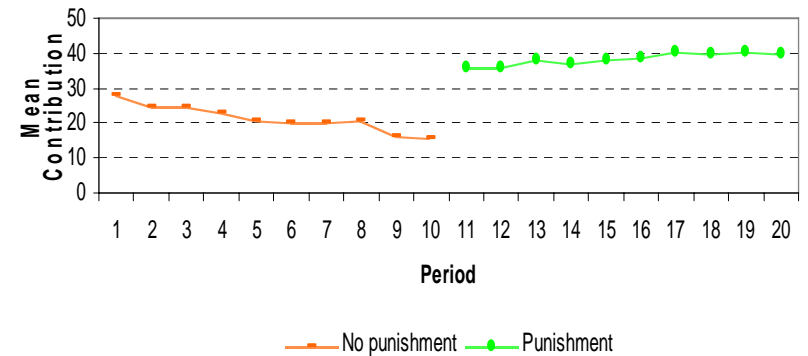
- Punishment increases cooperation
- Partner treatment has higher average contributions than the shuffled condition

Mean Contributions and Punishment by Cultural Types in the shuffled condition

Mean Contributions by Cultural Types
in No Punishment and Punishment treatments, Shuffled

contribution in VCM   contribution in punishment VCM

Cut-point for grid=0.37,group=0.47

Mean Punishment Expenditure
Punishment VCM, Shuffled

Cut-point for grid=0.44,group=0.47
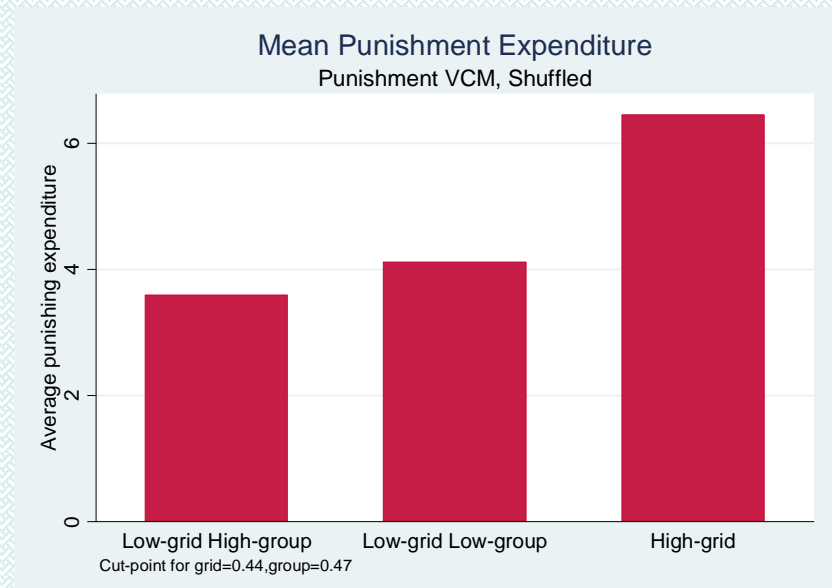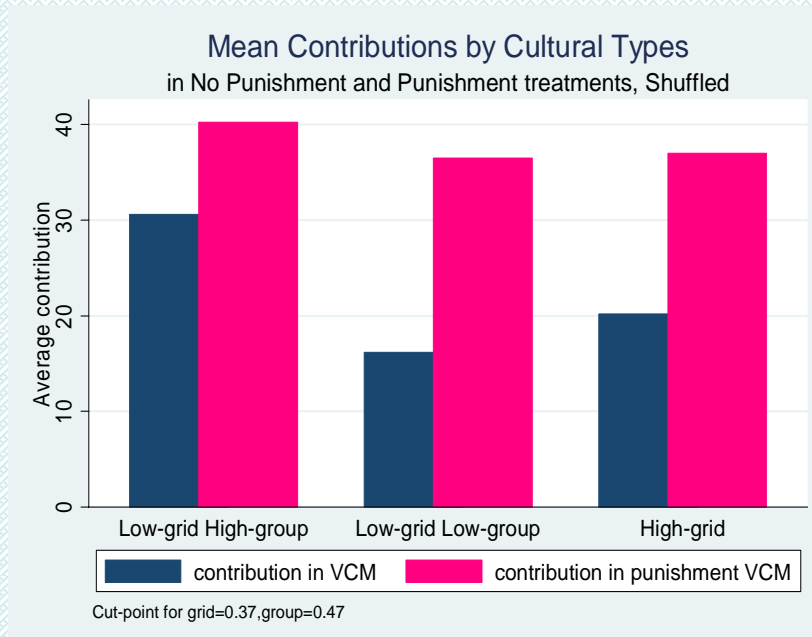
24% low-grid-high-group (cooperators)

26% low-grid-low-group (self-regarding)

50% high-grid (conditional cooperator)

- **High-group individuals contribute more than low-group individuals**
- **High-grid individuals punish more than low-grid subjects in the Punishment VCM**

VCM results: contribution and punishment

- <u>Groupness effect</u>: High-group individuals contribute more in VCM than low-group individuals

- <u>Gridness effect</u>: High-grid individuals punish more than low-grid individuals in the shuffled treatments

- <u>Matching effect</u>: Contributions were higher in partner groups than in shuffled groups; also punishment expenditure was higher in the partner condition

- <u>Punishment effect:</u> VCM with punishment produces higher level of contributions than non-punishment VCM because all types of individuals respond to threat of punishment

VCM result: Framing effect

Mean Contributions
Punishment VCM, Shuffled

Mean Contributions
Punishment VCM, Partner
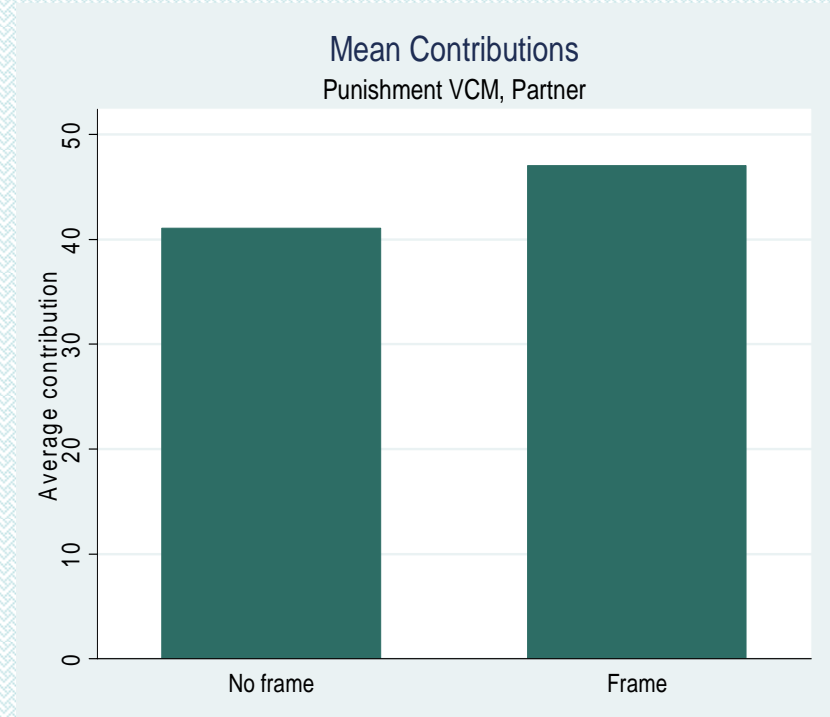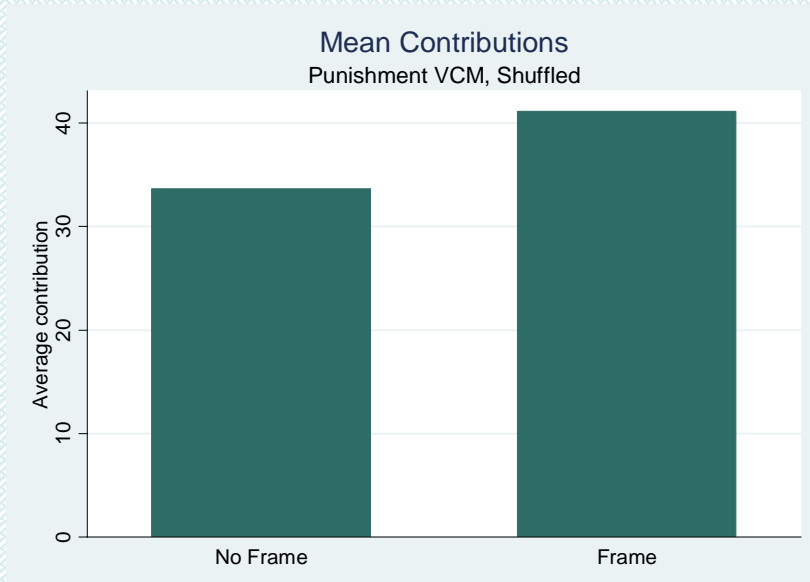
Frame - average group opinion about the fair contribution obtained through the survey was reported for each group

- **Framing effect was significant in the Punishment VCM**
- **No framing effect in the No punishment VCM**

VCM result: efficiency

- Efficiency in VCM with and without punishment were the same due to monitoring cost and reductions in payoff in the punishment VCM

- However punishment was targeted toward low contributors; no systematic evidence on antisocial punishment

Ultimatum, trust game results

- <u>Standard Ultimatum game:</u> Group scores were positively correlated with the average offers. Proposer's offers had a single dominant mode at 50 percent. The grid indicator was silent due to low number of rejections.

- <u>Convex Ultimatum game</u>: Proposer's dividing rule had a dominant mode at 50 percent split. The average dividing rule was higher with the shuffled treatments. The majority of responses (53 percent) from designators were to divide 10 dollars rather less. Average amount of dollars to divide was significantly lower for high-gridness designators. The higher is the percentage that divider sends to designator, the higher is the amount of dollar designator divides.

- <u>Trust game:</u> High groupness subjects when paired with the same person willing to trust more than low groupness ones. 75 percent of subjects trusted others and most dominant responses were 5, 0 and 10 in the descending frequency order. Among received 10 dollars high-gridness individuals reciprocate and sent back significantly more than low-gridness individuals.

VCM Sorting results

- <u>VCM</u>: sorting of high-groupness subjects in one team produced higher level of output than the random assignment of types into groups.

- <u>VCM</u>: allowing high-groupness to be visible to others as a role model did produce the same result as in the random groups.

- <u>Punishment VCM</u>: assignment of high-gridness with low-groupness subjects had higher level of punishment and lower level of output <u>due to antisocial punishment</u>

- <u>Punishment VCM</u>: assignment of high-gridness subjects to punish others did produce the same efficiency as in the unsorted groups. Punishment were no different across sorted and unsorted groups.

- <u>Assurance game</u>: clustering of high-gridness subjects shows that high-gridness subjects like less-risky payoff, while high-groupness subjects choose Pareto dominant payoff. The size of the group has negative effect on coordination

Further research on culture & cultural change

- <u>Culture (Identity) and group formation</u> : individuals favor member of their own group (nationality) rather out-group member (discriminatory preferences)
- <u>Cultural change</u>: boundaries of own group may change endogenously which in turn creates interaction among new boundaries

Mahalo!

Mean Contributions by Cultural Types
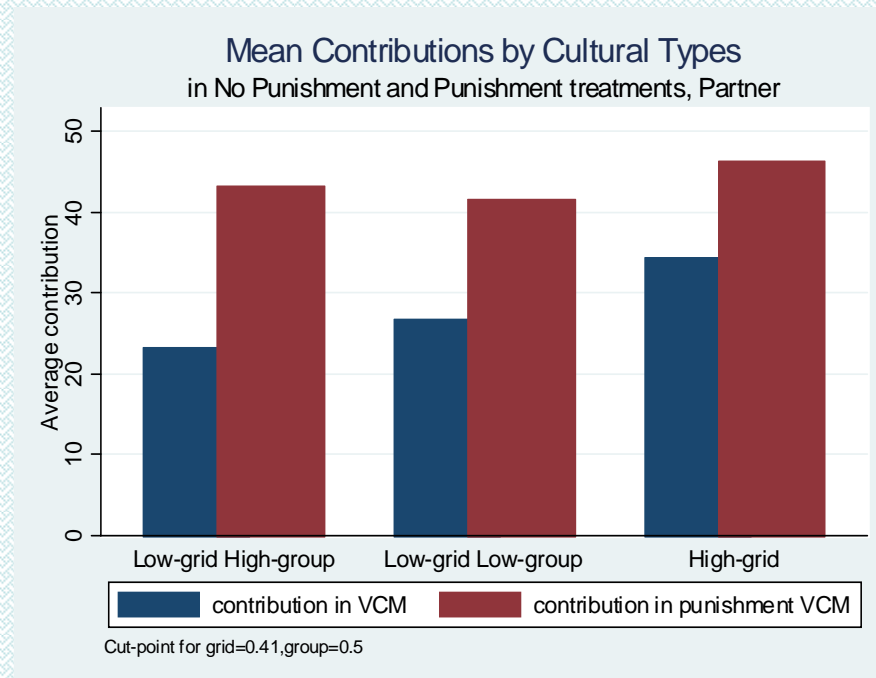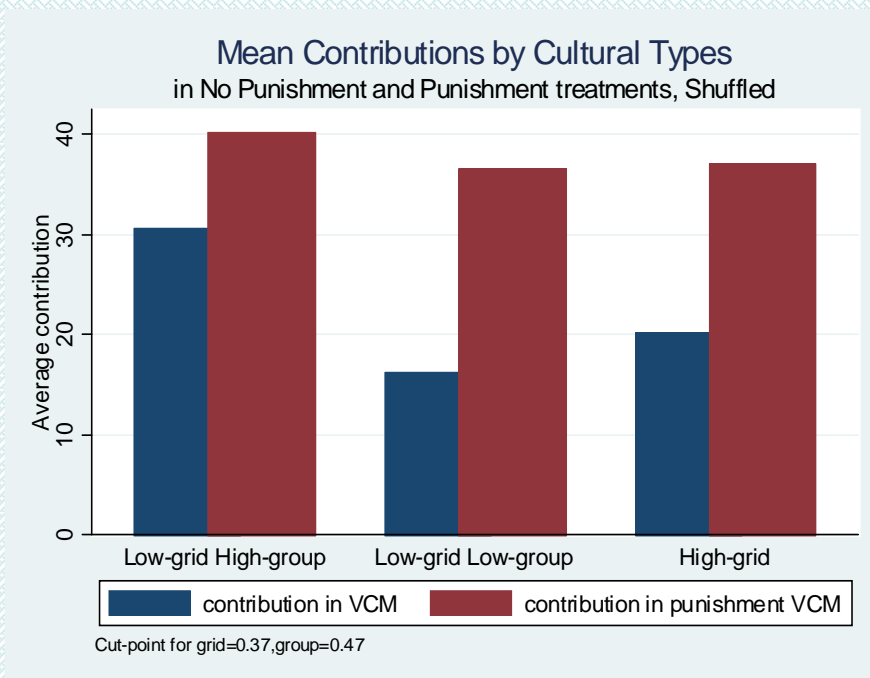
Mean Contributions by Cultural Types
in No Punishment and Punishment treatments, Shuffled

Cut-point for grid=0.37,group=0.47

Mean Contributions by Cultural Types
in No Punishment and Punishment treatments, Partner

Cut-point for grid=0.41,group=0.5

24% low-grid-high-group (cooperators)	**21%**
26% low-grid-low-group (self-regarding)	**32%**
50% high-grid (conditional cooperator)	**47%**

Mean Punishment by Cultural Types

Mean Punishment Expenditure
Punishment VCM, Partner

Mean Punishment Expenditure
Punishment VCM, Shuffled
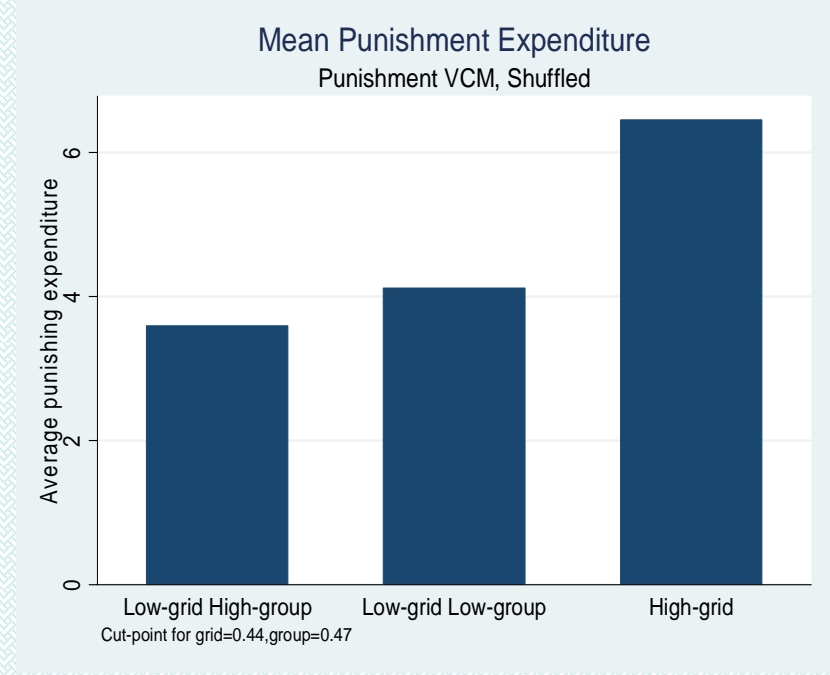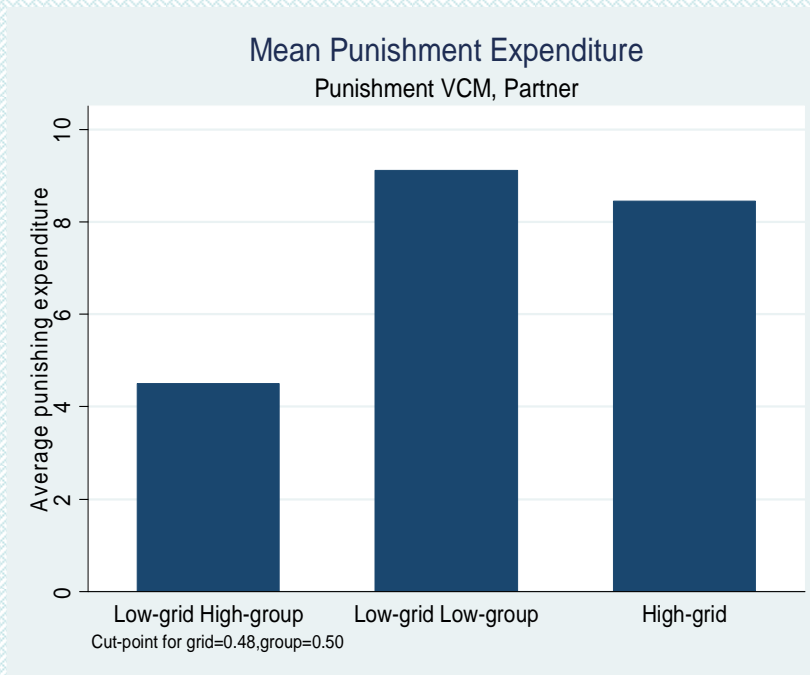
High-grid individuals punish more than low-grid ones in the shuffled treatments

Low-grid-Low-group individuals punish in the partner treatment for the selfish motive

Summary

- Groups attribute significantly correlates with the higher contributions in VCM in both stages (altruism)
- Grid attribute significantly correlates with the higher punishment in the shuffled VCM treatments. High-gridness types punish more than low-gridness types in both stages (strong reciprocity)
- Group scores were positively correlated with the average offers in the standard ultimatum game. Average amount of dollars to divide was significantly lower for high-gridness designators in the convex version of ultimatum game.
- High-groupness individuals are more likely to trust others in partner matching rather in shuffled matching. Among trusted high-gridness individuals reciprocate and sent back significantly more than low-gridness individuals.
- High groupness subjects select Pareto optimal payoff choice than low groupness ones in the assurance games. High gridness individuals choose non-risky payoff choice
- Clustering of high-groupness individuals generates higher performance than the random assignment of cultural types in VCM

Offers in ultimatum game

Figure 3a. Ultimatum game offers, $: Shuffle matching
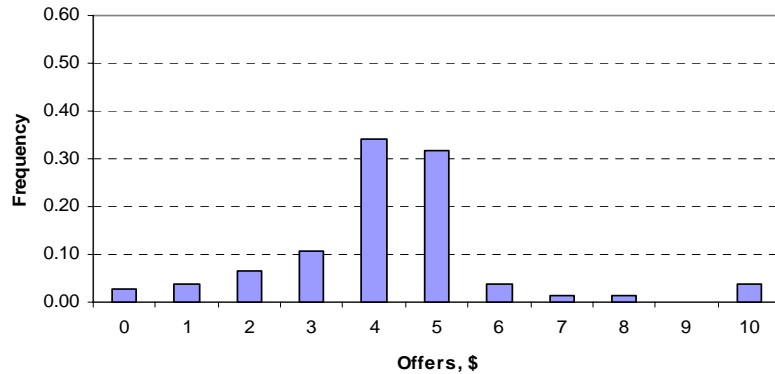
Figure 3b. Ultimatum game offers, $: Partner matching
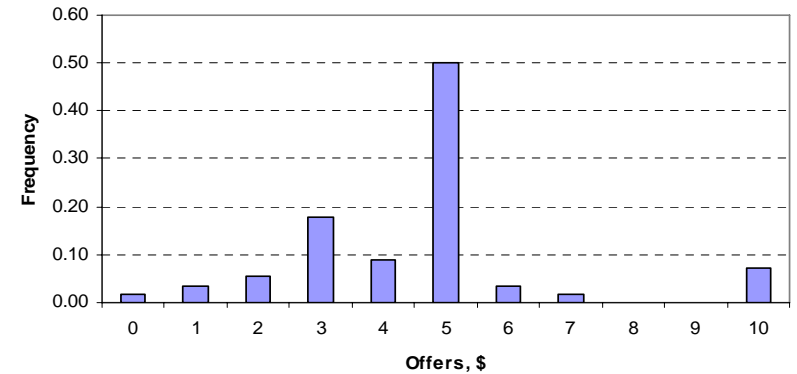
Figure 3c. Ultimatum game offers, $: Frame
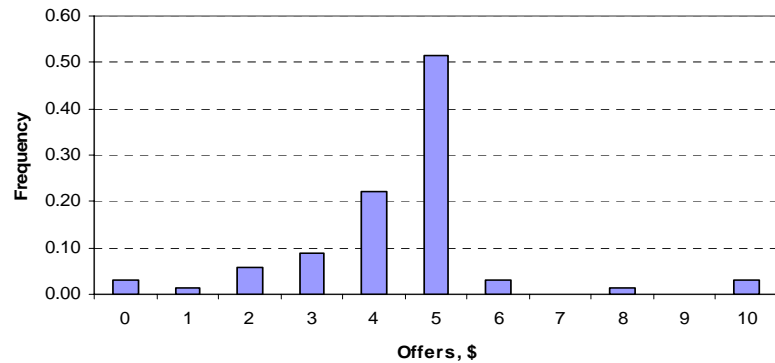
Figure 3d. Ultimatum game offers, $: No Frame

TABLE OF CONTENTS

Title: Endogenous preference change and group behavior in experiments.

Sun-Ki Chai, Dolgosuren Dorj, Ming Liu

Abstract

We manipulate incentives to predict preference change in public good experiments.124 subjects were placed in ten decision rounds of modified VCM followed by the ten rounds of regular VCM. As predicted half of population exhibit state dependent preferences, i.e. contribute in the modified games and withdraw from public account in the regular game (institution-responsive type). Even though incentives reflected the rationality to contribute in the modified games and free ride in the regular game, there was a minority of subjects who remain not contributing in all states (non cooperator or free rider). Another minority kept contributing in all states (unconditional cooperator). Depending on whether the state is stochastic or not the percent of non cooperator and unconditional cooperators changes in a way that with more noisy and risky environment percent of non-cooperators increases while the percent of conditional cooperators remain stable. Our risk preference measure reveals that about seventy percent of subjects are risk-averse. Cooperators turn out to be more risk seeking than other behavioral types. Risk-averse people contributed less in the regular games. Further, we find that the group (altruism) attribute was positively and significantly correlated with the level of contributions in the modified VCM. We find that cooperators and institution-responsive types have higher group and higher grid scores whereas non-cooperators have low scores in both dimensions. This result again validates our survey measure that correctly predicts individual differences with respect their behavior.

CCPV round 2 paper (December 2009 experiments)

Introduction

Early economics studies assume payoff maximizing individuals with self-centered preferences. However, evidence on social preferences abundant around us, for example voters do care about the social welfare and participate in election despite the miniscule effect of ones vote on the electoral outcome. Great amount of work in a society is performed by volunteers who benefit others with their devoted time. Heroic actions to help others during devastating times of disaster, war or simply rescuing ones life from fire, flood are reported everywhere. Some people risk their life in demonstrations, protests to benefit other group members. Overwhelming amount of income for churches come through charity and donations. People pay their taxes. These examples are driven by moral norms, social norms that are internalized by the actor. Recent studies on static social preferences demonstrate that social motives such reciprocity (Rabin 1993, Dufwenberg and Kirchsteiger 1998, Falk and Fischbacher 1998), difference/inequity aversion (Bolton and Ockenfels 2000, Fehr and Schmidt 1999), and altruism/social welfare (Andreoni and Miller 2001, Charness and Rabin 2002) are the underlying reasons of human behavior. However, little is known about how these social preferences change over time.

Related line of research on preference change connects to the famous study in psychology, Rober's Cave experiment (Sherif et. al 1954/1961) demonstrating a group formation process, which triggers the change in preferences from antagonistic to favorable among two groups of twelve years old boys who were brought to camping for two weeks. In this study, competition among teams brought hostile attitudes toward out-group members in the first place. However, common goal oriented activity changed students to be more cooperative toward the other team and helped to eliminate prejudice between teams. In the similar field study Swiss platoons were brought together in the classroom, where they get to play the prisoner's dilemma game with and without punishment opportunity. It has been shown that officer were more cooperative when the matched person was from the same platoon (Goette et al., 2006). The aim of this paper is to replicate Rober's cave experiment in the laboratory condition and demonstrate mainly the preference change rather to show the in-group favoritism or out-group discrimination. Moreover, we explore preference change that occurs relatively in a short period of time that can be accommodated in the regular lab study that lasts less than two hours.

Experimental studies demonstrate that subjects exhibit change in their actions depending on the environment of the game they face such as institution, group, or information structure. For example, with punishing institution group may achieve social optimum whereas without such incentive schemes group may fail to cooperate (Fehr and Gochter, 2000). On the other hand, subjects may change their behavior in accord with environmental conditions, i.e. risky versus non-risky conditions. For example, risky condition introduced to the private account in the public good context induces subjects to

be more cooperative. As long as risk removed subjects start free riding and contributing less to the public account (Chai, 2008, Gangadharan and Nemes, 2009). Work condition whether it is competitive or not affects cooperativeness, i.e. fisherman and trader who had more competitive work environment were tend to be less cooperative whereas staff in the trading coops were more cooperative (Carpenter and Seki, 2005). All these changes in behavior were triggered by incentive schemes, by so called informational structure of the game, but not by the internal willingness of subjects to change their behavior. Previous studies documented heterogeneity in humans, where a minority of subjects has hard core characteristics either to free ride or cooperate regardless of condition. However, majority of subjects are conditional cooperator who reward other for good behavior and punish other for non-cooperative actions (Fehr and Gachter, 2000, Ones and Putterman 2007). In the public good context it has been shown that majority will retaliate to contribute seeing other are not contributing (Fischbacher et al., 2001).

So far, there was no research that shows how under the dominant strategies to free ride all group members regardless of their types would internalize the negative externality and achieve cooperative outcome. Exception applies to the research in economics and social psychology on the in-group favoritism or out-group discrimination (Tajfel, 1978). Social identity theory states that when people act as group their behavior is different from one of isolated individual; individuals identify themselves with certain groups which is an important source of pride and self-esteem (Tajfel and Turner 1979, Chai 2001, 2005, Akerlof and Kranton 2000, 2005). Individuals identify themselves with the own group ("us") as different from all other heterogeneous outsiders as homogeneous out-group ("them"). Experimental evidence suggests with such group membership subjects tend to behave nicely toward in-group members (Charness et al. 2006, Chen and Li 2006, McLeish and Oxoby 2007). Hence social identity and group membership insures trust which in turn encourages cooperation within the group. Eckel and Grossman (2005) suggest that simple, artificial identity does not alter cooperation while interaction among team members on achieving preproduction goal enhances cooperative behavior. Contrary, Ahmed (2008) argues that the presence of out-group is not necessary to induce in-group bias. Any arbitrary label may create group favoritism due to human's self-esteem that makes one predisposed to own identity. Interestingly, in the public good experiments J.L. Solow, N. Kirkwood (2002) found that members of different social groups may behave differently. For example, if the University Band members act cooperatively, members of sorority/fraternity groups may compete with each other. In Chuah et al. (2007) cross-country study group favoritism was more pronounced among Malaysians and their offers were sensitive to the location in the sense that in the cross-cultural conditions, proposers playing on foreign soil made larger offers than home proposers. Another cross-country research by Buchan and Croson (2005) shows that temporary induced groups in the US favored own group (discussion group), but Chinese sent and returned more to the out-group (non-discussion group). Contrary to Fukuyama's proposition, hypothetical responses (Buchan and Croson 2004) demonstrated higher amount sent and returned (higher level of trust) in China. In-group favoritism was evident in naturally occurring groups such as Swiss platoons (Goette et al. 2006), ethnic groups in Uganda (Habyarimana et al. 2007), and among two ethnic groups in Papua New Guinea (Bernhard et al. 2006). Another field study in India by Hoff and Pandey's (2006) among 6-7 graders shows that

revealed social status (caste) within heterogeneous-caste environment prevents achieving higher performance among low-caste students. Ethnic group status was one of the factors that affected discriminatory preferences among Vietnamese villages such that poor minority (Khmer) exhibit in-group favoritism while majority (Vietnamese) and rich minority (Chinese) do not exhibit in-group bias toward Khmer, however the majority and rich minority showed solidarity when matched together (Tanaka et al. 2008). Priming the neighborhood identity through questionnaire among African-Americans produced divergence in the donation behavior among woman (Li et al. 2007). In the time and risk preference study priming the ethnic identity through questionnaire among university students demonstrated that Asian-Americans become more patient while black subjects who lived several generations in US become more risk averse (Benjamin et al. 2007). Priming the school identity suggests that Asians favor in-group while Caucasians favor in-group only when school identity is salient (Chen et al. 2008).

The social identity theory that explains in-group favoritism by self-esteem was challenged by group heuristic model which explains in-group bias simply by motives of generalized reciprocity within the group that can't be avoided even by free riders (Karp et al. 1993, Jin et al. 1996). In the Yamagishi et al. (2008) study, where minimal groups were induced using Klee and Kandinsky painting preferences, the group heuristic model was confirmed by capturing in-group favoritism as a universal preference relevant both for Japanese and New Zealanders who strongly identify themselves with their group. While Yamagishi et al. (2005, 2008) manipulated knowledge about the group membership (whether both or one of participants aware of the their group membership), experiments by Karp et al. (1993), Jin et al. (1996) successfully eliminated in-group favoritism by making one's earnings independent of other member's decision. Yamagishi et al. (2005) used the nationality as a group category and found that Japanese identity was weak compared to Australian. According Yamagishi (2008) the knowledge manipulation effect (in-group favoritism in the mutual-knowledge condition) must be greater in collectivist societies because the cost of exclusion from general exchange system presumed to be higher in collectivist rather in individualist societies. On the other hand, Yuki (2003) argues that the knowledge manipulation effect will be greater in the American culture because the group membership induces already a perception of groupness, while in the collectivist society groupness refers to the relationships among members and just group category presumes not enough to induce in-group favoritism. Given this contradictory views on the relative strength of knowledge manipulation effect in different cultures we provide alternative view for explaining behavior.

Objective of the experiment: test the preference change over time. Our research aim is to show preference change in the group that facilitates cooperation in the voluntary contribution mechanism (VCM hereafter). It has been long debate on cooperation and selfish behavior in voluntary contribution mechanisms. Standard economic model predicts that selfish players would contribute nothing in public good games while other-regarding models predict some level of cooperation due to altruism, group behavior and social norms. Ledyard (1995) summarizes various factors that may influence cooperation: group size, marginal payoff, experience, threshold, rebates, communication and uncertainty. Ambiguity is considered as a situation when player is uncertain about the

other's contributions. In a public good game with strategic substitutes and positive externality and where players display concave utility function ambiguity increases contribution (Eichberger and Kelsey 2002). Various uncertainties have been introduced into analysis such as uncertainty about the other's degree of altruism (Palfrey and Rosenthal 1988); uncertainty about the other's contribution cost (Palfrey and Rosenthal 1991); uncertainty about other's valuation of public good (Menezes et al. 2001); unknown pool size (Budescu et al., 1995); and unknown threshold (Ramzi Suleiman 1997, Nitzan and Romano 1990). Gradstein et al. (1993) showed that artificial randomness in prices alleviates the free rider problem and increases welfare. Keenan et al. (2006) extend a view that the price uncertainty reduces free-riding. Experiments report uncertain group payoffs reduce individual contributions but not the group contributions (Dickinson 1998). Dale (2004) provides more evidence on a fixed-prize lottery structure that induces higher level of public good than does a revenue-dependent lottery.

None of these existing studies focus on endogenous change of preferences over time. Depending on the audience, it would also be useful to analyze explanations from economic sociology and exchange theory, but it is fairly straightforward to show that these are not really designed to explain shifts over time in contributions. Dynamics explanations would also be discussed, but much of existing work does tend to focus on natural selection arguments, in which fixed types are removed or added to the population. This includes Ostrom (2000), and also theoretical work by Bowles and Gintis et al. (2003), Rajiv Sethi (2006), and Bendor, Mookherjee, and Ray (2001). This could not explain change within among a group of subjects that remains unchanged throughout. Learning models, on the other hand, examine repeated games in which high levels of cooperation could be one of many equilibrium strategies due to reputation effects and possibilities for punishment, and hence do not require social preferences.

The main purpose of this paper is to examine preference change over time as an explanation of cooperation in a simple public good environment. We provide answer to the following research question: would subjects cooperate in the non-induced groups given incentive scheme such as VCM that follows the modified VCM with the stochastic payoff? The procedure to check the preference change is the following. All subjects are divided in groups of four and will be placed in ten rounds of the modified VCM game in which the defection is prone to uncertainty even though expected payoff from cooperation is higher than the expected payoff from defection. This incentive structure increases willingness to cooperate. Under payoff equivalent conditions from cooperating or defecting, risk-averse subjects will cooperate. Risk-neutral subjects suppose to be indifferent between alternative actions and will proceed with mixed strategies. However, we parameterize the game in a way that both risk-averse and risk-neutral subjects will have dominant strategy to cooperate. Indeed in our previous study with VCM we have shown increase in contributions in the public account even with the risky private exchange that produces marginally higher expected returns than the returns from the public exchange (Chai 2008). Our expectation is that all subjects will choose cooperative action when payoffs are uncertain. Then we place subjects in ten rounds of a regular VCM game where the dominant strategy would be for the self-centered person to defect. Preference change occurs if we observe a continuation of cooperation in the second game

meaning that all team members internalized the common goal and pursue collective action to benefit their group which improves overall welfare of community as a whole. Therefore, cooperation rate suppose to be higher in the design when subjects experience stochastic modified game than non-stochastic game. This will be especially true for subjects who lost money from previous ten rounds of play by cooperating.

Hypothesis 1: Preference change occurs more for low-group individuals. Low-groupness subjects will contribute more in the regular game than high-groupness individuals;

Hypothesis 2: effect in hypothesis 1 is stronger in the regular game followed after the stochastic game than in the regular game followed after the non-stochastic game.

Experimental Design:

Total 124 students from the University of Hawaii at Manoa campus participated in one of eight sessions ran during December 2009 (Table 1). Entire experiment was run using computer networks using z-tree (Fischbacher 2007). Each session was comprised of three parts: attitudinal survey, risk measurement task, and ten period of modified VCM followed by ten periods of standard VCM. We induce the preference change through two treatments. We test our predictions using standard procedures that do not induce group formation. Subjects in randomly matched groups experienced total twenty periods of two games. In the experimental condition ten periods of modified stochastic VCM game is followed by ten periods of standard VCM game. Modified VCM game had higher expected payoff than the standard VCM in such a way that cooperation involves some level of risk[1] related to the public account return. Therefore with fifty percent probability[2] subjects had chance to end up with high payoffs and another half of time the payoffs could be low. We test whether cooperation obtained in the modified VCM game would continue to sustain in the standard VCM game. Evidence on cooperation in the standard game will indicate endogenous preference change. In the control treatment the modified VCM with no risk was followed by the standard VCM. Difference between last two standard games in the experimental versus control treatments shows the preference change effect. In order to eliminate cooperative motives in repeated setting, we re-shuffled subjects every round so that there is no reputation effect. The parameters for each treatment are presented in table 2.

---

[1] Computer randomly draws number between 0 and 1 and if that number is smaller or equal to 0.5, then payoffs for each players who invested in the group account is high (mpcr=2), otherwise the payoffs are low (mpcr=0.5).

[2] In resource dilemma situations two types of uncertainties were identified: strategic uncertainty refers to the uncertainty about other group members actions and environmental uncertainty refers to the uncertainty related to the pool size (Suleiman and Rapoport 1989). In our two treatments strategic uncertainties were kept constant with varying uncertainty of the return from the public account. In this study we pursue uncertainty with known probabilities, i.e. risky situation while unknown probabilities reflect uncertain condition.

Table 2. Return from group and private accounts			
	MPCR	return from individual account	Group size
modified VCM:			
A stochastic	2 (50%) or 0.5 (50%)	1	4
B non-stochastic	1.25	1	4
standard VCM:	0.5	1	4

As Table 2 describes, stochastic modified VCM introduces uncertainty into the group exchange so that with fifty percent probability return per token from the group exchange may be 2 and with fifty percent probability return may be 0.5. This will result in the expected payoff from the every token invested in the group exchange equal to 1.25. In contrast, in the non-stochastic modified VCM group exchange certainly returns 1.25 for every token invested, so it is a dominant strategy to invest in the group exchange since return per token invested in the individual exchange is equal to one. In the standard VCM, group exchange returns 0.5 for every token invested in that exchange; hence the dominant strategy in this game would be to invest in the individual exchange. In all conditions individual exchange return one token for every token invested in that exchange.

Survey and risk measure

Previous research correlates trusting attitudes with the trusting actions (Glaeser et al. 2000, Ahn et al. 2003, Ashraf et al. 2003, Danielson and Holm 2003, Gächter et al. 2004) and contributing actions (Capra et al. 2008, Fehr et al. 2002), or attitudinal question responses in the ultimatum game (Chuah et al. 2009). However, none of these studies attempted to measure social preferences through attitudinal questions except studies that use a ring test which predicts behavior by behavior (Offerman et al., 1996; Sonnemans et al., 1998, Van Dijk et al. 2002, Liebrand 1984), or sorting of types based on their altruistic scores obtained from the psychology personality questions (Ma et al. 2002). The latter studies happen to deal with measuring social motives such as altruism, but not reciprocity which is available through our instrument.

One of the objectives in our research is to find whether social preferences expressed through attitudinal question responses may be a good predictor of behavior. We provide our instrument to measure social preferences such as grid/group questionnaire that contains selected questions from the World Value Survey (WVS). The survey allows us to predict behavior in the lab under various conditions discussed above. One advantage of having survey is that it allows us to determine the composition of types beforehand, employ sorting of types independent from participant's current action, and predict behavior in experiments.

Within the grid-group model, group represents the extent to which a culture emphasizes positive or negative altruism towards other individuals, as opposed to pursuit of self-interest. Grid, on the other hand represents the extent to which a culture embodies a reliance on standardized role-based rules for achieving goals, as opposed to general approaches to problem-solving. This framework is chosen because of its parsimony, the fact that it is probably the best-known formalized classification of cultures within the contemporary social science literature, and because its two abstract dimensions have been shown to be accurate predictors of numerous concrete cultural predispositions. While its two dimensions are deceptively simple, they also provide a systematic framework for organizing large numbers of more specific cultural attributes (Douglas 1970; 1989; Douglas and Wildavsky 1982; Chai and Wildavsky 1994; Chai and Swedlow 1998).

The grid-group model is more than simply a taxonomy. Both grid and group have implications for a wide range of actions across diverse environments. Stated in basic fashion, low-group cultures will tend to have self-interested preferences based upon a individualized identity, while high-group cultures will be characterized by altruistic preferences towards others within their own collectivity, based upon a "fused", collective identity. High-grid cultures will tend to prefer to adherence to rules of conduct based on social norms, particularly those of equity and reciprocity within the collectivity, even under conditions where this does not directly benefit them. Low-grid cultures, on the other hand, will tend to ignore such norms and decide to do things "their way". These are general tendencies, and hence are not tied to any particular set of conditions or interactions.

The grid-group survey instrument allows one a more nuanced definition of the type of individuals being allocated. Economists have found it useful to classify individuals as one of three types. Two of these types have seemed to have clear correlates in the grid-group framework: unconditional cooperators (Low Grid– High Group) and unconditional non-cooperators (Low Grid – Low Group). The third category, conditional cooperators, would seem to encompass High Grid individuals of either type, high or low group. By distinguishing the grid and group characteristics of the individuals, we can get a more comprehensive understanding of the interaction dynamics of these unique types. Moreover, because the grid-group framework is a general one that applies to multiple kinds of games, not just VCMs, it can help to infer how individuals who behave in a particular way in a VCM might behave in a completely different type of interactions.

We administered the survey consisting of 22 questions prior to the treatment. Based on the answers subjects provide each of them were assigned a grid and group scores. The footnote in this page provides formula to calculate grid [3] and group[4] indexes.

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[3] grid=((4-Answer[3])/3+(3-Answer[6])/2+(3-Answer[7])/2+(3-Answer[10])/2+(2-Answer[11])/1+(3-Answer[15])/2+(Answer[18]-1)/9+(10-Answer[19])/9+(10-Answer[20])/9+(10-Answer[21])/9+(10-Answer[22])/9)/11;

[4] group=((4-Answer[1])/3+(4-Answer[2])/3+(2-Answer[4])/1+(2-Answer[5])/1+(Answer[8]-1)/1+(Answer[9]-1)/3+(3-Answer[12])/2+(3-Answer[13])/2+(Answer[14]-1)/2+(Answer[16]-1)/9+(10-Answer[17])/9)/11;

Another tool we used in the pre-treatment stage immediately after the survey is the risk measure adopted from Brown and Stewart (1999). Subjects were presented a lottery where option A always returns $5 whereas option B pays either five or zero dollars with different probabilities. We identify subjects to be risk-lovers if the person switched from non-risky option to risky option in situations 1-4. Those switched exactly at situation 5 classified as risk-neutral and those switched in situations 6-10 considered as risk-averse. Participants were not informed about the results of the lottery until the end of the session.

Results

Aggregate results

We present results using session averages as a unit of independent observation since groups of four were randomly reshuffled in the session during twenty rounds of tasks.

Result 1 (stochasticity): *In line with prediction average contributions in the stochastic VCM were no different than the average contributions in the non-stochastic VCM.*

Support

Since the expected marginal per capita return (MPCR) for the stochastic VCM was the same as the MPCR in the non-stochastic VCM, on margin subjects contributed the same amount in the stochastic and non-stochastic games (0.67 and 0.81 respectively). Almost ¾ of population in the group contributed to the group exchange. Wilcoxon-Mann-Whitney test that compares session's averages across treatments shows marginal no difference between contributions in the stochastic versus non-stochastic games (p=0.0814).

Result 2 (uncertainty): *Stochastic and non-stochastic modified VCM treatments produce higher level of contributions than the regular VCM.*

Support

Average contributions were 0.67 and 0.81 in the stochastic and non-stochastic games compared to 0.34 and 0.39 in the regular games followed each respectively. Contributions dropped significantly in the regular VCMs followed after the modified VCMs. The difference between modified version of the VCM and regular VCM is significant at 5 percent level (Wilcoxon-Mann-Whitney test p-value=0.0202, 0.0209, Table 3).

Previous research shows that in the common pool resource dilemma situations uncertainty about the pool size reduces cooperation levels and subject's extraction level

increases (Rapoport et al. 1992, Hine and Gifford 1996, Gustafsson et al. 1999a; 1999b). Similarly, in the public good games uncertainty about the provision threshold level reduces cooperation (Wit and Wilke 1998). In our experiments subjects in the modified games face uncertain outcomes with known probabilities that will be categorized as a risky situation. In the modified games the risk was the same across stochastic and non-stochastic games. Therefore, in our experimental data contributions in regular games were lower than contributions in the stochastic/non-stochastic condition (p=.0202 and p=0.0209, table 3).

Result 3 (dissonance) *Average contributions in the regular VCM that followed after the stochastic game were no different from average contributions in the regular VCM that followed after the non-stochastic game.*

Support
According the predictions, contributions in the regular game that follows the stochastic game suppose to be higher than contributions in the regular game that follows the non-stochastic game; however mean contributions were low and no different from each other in the regular VCM for both control (0.39) and experimental (0.34) sessions (Wilcoxon-Mann-Whitney test p=0.3865, Table 3). On average only one to two subjects contributed in the regular games compared to three to four members in the modified games. We believe that framing in the instructions that emphasizes the relative payoffs affected the results in a way that in the stochastic and non-stochastic games not full contributions were obtained (0.67 and 0.81) and in the regular games significant drop in contributions was observed (0.34 and 0.39).

Result 4 (grid/group measure): *Group scores were positively correlated with the contributions in the stochastic and non-stochastic versions of the modified VCM. Grid scores were positively correlated with the contributions in the regular VCM followed after the stochastic game.*

 Support

Pearson coefficient shows significant correlation between mean contributions and group scores in the modified versions of the game (Pearson p-value=0, Table 4). Random effect GLS regression with panel data show that in both the stochastic and non-stochastic games groups scores were positively correlated with the contributions (p=0.038 and p=0.065 with R-squared=0.03 both) while in the regular games group score was salient. Contributions in the ten periods of regular VCM played after the stochastic game were higher for those with high grid score (p-value=0.0118, Table 4). This suggests that high-grid individuals are more prone to stochastic environment because they have higher regret of not cooperating in the second ten rounds.

Therefore, heterogeneous preferences were observed in our data for the group attribute ranging from .15 to 0.74 and for the grid attribute maximum score was .91 with the minimum of .05. Correlating cultural attributes with the contributing behavior shows

significant result for the group cultural attribute for both stochastic and non-stochastic games. Grid score was positively correlated with the contributions in the regular VCM followed the stochastic game.

Result 5 (risk measure): *Majority of subjects exhibited risk-aversion with fewer risk-neutral subjects and risk-lovers. Risk attitudes affect contributions in a way that contributions are higher in less-risky condition.*

 Support

We counted that 72.6 percent of our sample were averse to risk. 12.9 percent were risk-neutral and 14.5 percent were risk-lovers (Table 5). Pearson coefficient shows significant correlation between mean contributions and risk-aversion in the non-stochastic versions of the game (Pearson p-value=0, Table 4). Random effect GLS regression with panel data show that in the non-stochastic games risk-averse subjects contributed more (p=0.017).

These are correlates with respect to the elicited preferences based on the survey responses and risk measure. Next we will identify state-dependent preferences, i.e. subjects behavior may change depending on the environment/institution they were placed.

Individual behavior

Next we classify behavioral types based on their actions taken in the modified and regular games. Institution in the stochastic game suggests contributing for the rational agent, while incentives in the regular game would be to keep the resource in the private account. We define cooperators as contributing regardless of the institution in more than fifty percent of time (modified or regular treatments), while free riders[5] keep their money in their private account irrespective of the institution in more than fifty percent of time. Institution-responsive types cooperate in the modified game in more than fifty percent of time and free ride in the regular game in more than fifty percent of time. We counted 26.6% of population in our sample as cooperators[6], 21.8 percent free riders, 46.8 percent institution-responsive and 4.8 percent of subjects unclassified. Exactly 21.8 percent of participants also answered in the post questionnaire that they were ``considered only benefit to self'' which coincides with the percent of free riders in our sample. Interestingly, as we would expect on average cooperators and institution-responsive types have higher group scores (0.53, 0.52), higher grid score (0.46, 0.44), while free riders have lower group scores (0.46) and lower grid scores (0.41). See Table 6, 7.

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[5] Incentives in the stochastic game suggest rational agents to contribute. Free riders in the stochastic or non-stochastic games might be confused by the framing, hence did not contribute in those games. Suppose there was a framing effect (framing emphasizes the relative payoffs); even though we classify them as free riders because with framing the underlying motive not to contribute was to free ride on others. On the other hand, if those free riders were not confused, then antisocial motives only explain behavior, which is unlikely in our setting. In any case, we have a type of people who did not contribute in both games.

[6] Fraction of cooperators is quite high in our sample which indicates the presence of the stochasticity effect.

Cooperators and institution-responsive types have higher group score (Pearson correlation p=0 in both) and higher grid score (p=0.0043, p=0.0032) as compared to free riders. Interestingly cooperators turns out to be more risk-seeking than free riders (p=0.0422), and have lower grid score than other types pooled together (p=0.0083). Cooperators and institution-responsive type are no different in terms of group score and grid score, but cooperators are more risk-seeking (p=0.0335).

Comparing session averages by behavioral types shows that all behavioral types contributed the same amount in the regular game which follows the stochastic modified game as compared to the regular game which followed the non-stochastic game (Wilcoxon-Mann-Whitney test, p>0.1). All behavioral types also contributed on average the same amount in the stochastic game versus the non-stochastic game (Wilcoxon-Mann-Whitney test, p>0.1).

Budescu et al. (1990) suggest that in uncertain pool size situations people overestimate the size of the pool and may justify their over-harvesting behavior by the belief of larger pool. Large groups diffuse social motives ((Darley and Latané, 1968; Fleishman, 1980); similarly uncertain conditions may diffuse individual accountability and may serve as a justification of greed. Similarly, in our setting it is possible that subjects in the regular VCM justified their decision not to contribute. Contrary, Van Dijk et al. (1999) suggests that environmental uncertainty not necessarily deteriorate cooperation; cooperation depends on whether the setting is public good or common resource, or on the type of uncertainty faced, or on the asymmetry of positions (more tokens to allocate in the public good or allowed to extract higher amount in the common resource situation) and subjects ignore uncertain information and make decisions based on certain information.

Result 5 (risk effect): *Risk-averse subjects contribute more in the non-stochastic game and contribute less in the regular VCM followed after the non-stochastic game.*

Support

In line with expectations since there is no risk associated with contributions in the non-stochastic modified VCM, risk-averse subjects contributed more in this condition (Pearson p-value=0, Table 3). However, in the regular game risk-averse subjects contributed less since group exchange was associated with the uncertainty to have low payoff if others do not contribute (Pearson p-value=0.0159, Table 4) . Interestingly, previous research finds that depending on the risk attitude people act differently to uncertain conditions. Risk-seeking people requested more from the common pool resource than risk-averse individuals (Budescu et al.1990). Our data shows that risk-averse individuals contributed marginally less in the regular games (uncertain condition) than in the modified games (mean is 0.65 vs. 0.33 in stochastic, 0.85 vs. 0.38 in non-stochastic, Wilcoxon signed ranks test p=0.0679 in both).

Also people with differential pro-social motives perceive the uncertain situations differently. For example, individualists increase their harvesting levels while cooperators and altruists harvest less or held their extraction level constant (Roch and Samuelson

1997). Similarly, in our data only cooperator contribute more than other types (Pearson correlation, p=0) in the regular VCM game which was more uncertain than the stochastic game. In our data institution-responsive type and free rider were more risk-averse than cooperators, hence they did not contribute in the regular games that were more risky. In contrast, only cooperators left contributing in the regular game being more risk-seeking than other behavioral types (p=0.0422 and p=0.0335). See Table 8 for the contribution by risk-types.

Result 6 (membership effect): *Institution-responsive types withdraw from group exchange in the regular game, hence contributions drop significantly.*

Support
In both regular games which follows either the stochastic or non-stochastic games, cooperators contributed more than other behavioral types (Pearson correlation p=0). On the other hand, contributions between institution-responsive types and free riders were no different in the regular games that followed after the stochastic or non-stochastic game (Pearson p=0.6929, p=0.1485). However, institution-responsive types contributed more in the modified game than free riders (Pearson correlation p=0). Therefore, cooperator and instituton-responsive type significantly increased the contirbutions in the modified games, while free riders abstain from cooperation. Contrary, in the regular games institution-responisve types switched from group account to private account more than other types resulting in significant drop of contributions (Wilcoxon matched pairs signed ranks test, p=0.0117 both as compared to cooperators and free riders).

Yamagishi (1988) conducted experiment on free riding and exit comparing the tendency of American and Japanese subjects to leave the group. With low cost of exit, both American and Japanese participants were avoiding free riders by exiting the group at the same rate. However, with higher cost of exit Japanese participants had higher rate of exit (eight in twenty trials) as compared to American participants (one in twenty trials) suggesting that Japanese cooperate not of their intrinsic value of the membership and a group but because of the mutual monitoring and sanctioning available in the Japanese society. Similarly, in our experiment with no mutual monitoring in the regular games, majority of institution-responsive types exited the group account while cooperators kept choosing a group account. Mean percent of cooperative action by institution-responsive type drops from 38.7 and 44.1 to 9.5 and 6.9 percent respectively in the stochastic and non-stochastic sessions, Table 7. The data shows that the rate of withdrawal was no different between the non-stochastic and the stochastic games; suggesting that institution-responsive types were not affected by the stochastic condition.

Demographics:

54 percent of hired subjects were male and 46 percent were female. Among participants 46 percent were undergraduates, 37 percent were involved in master and 37 percent in doctoral program, 3 percent were unclassified. 29 percent were Mormon, Christian or Catholic, 8 percent were Muslim, 13 percent were Buddhists and 40 percent were non-religious. See table 9 for the participants' religious affiliations. Little more than quarter of

population (26.6 percent) grew up in rural area, 37.1 percent came from town and 36.3 percent came from big cities. Interestingly, contributions were higher among those grown up in rural areas in the regular games followed after the stochastic and non-stochastic games (regression p=0.076 and p=0.04 respectively). From the post questionnaire among answers about how much subjects consider the benefit to self and others, 55.6 percent were mostly considered the benefit to self and little cared about the benefit to others, 34.7 percent considered the benefit to self and others equally, while 9.7 percent did care about the benefit to others mostly. Those who do cared about the benefit to others were contributing more to the group account (regression p=0.083, 0.081, 0.006, 0 across stochastic followed by regular, non-stochastic followed by regular games). Also subjects answers whether they do care more about themselves or others (selfinterest) was significantly correlated with the contributions in the stochastic (p=0.056), non-stochastic game (p=0.003), and regular game followed after the non-stochastic game (p=0.002).

Conclusion

We use attitudinal survey responses to measure subject's cultural characteristics and correlate these attributes with the behavior in the lab experiments. In the stochastic and non-stochastic VCM experiments, group scores and contributions were positively and significantly correlated with each other. Grid score were positively significantly correlated with the contributions in the regular game that followed the stochastic game. Our within-subject design allows examining ones behavior in different environments, stochastic versus regular games, or non-stochastic versus regular games. Classification of subjects based on their institutional responses, i.e. actions taken by subjects in different environment, suggests that our tool was valid in a sense that cooperators and institution-responsive types had higher group and higher grid scores while free riders had low scores in both metrics. Our risk preference measure reveals the following. Cooperators turn out to be more risk seeking than other behavioral types. Risk-averse people contributed less in the regular games. Institution-responsive types exited the group account in the regular game contributing significantly to the drop in the cooperation level. Our attempt to induce preference change in non-induced (random) groups of students suggests that identity or pre-production activity may encourage cooperation in regular VCM. Second, framing that emphasizes the relative payoffs may discourage cooperative behavior, especially among risk-seeking individuals. Third, our analysis of the state-dependent preferences suggests that majority of population (46.9 percent in our sample) are institution-responsive, i.e. their behavior is dependent upon the environment. The result of the regular VCM game much depends on this portion of the population. The institution-responsive types were responsible for significant drop in contributions in the regular games. One extension of this research is to run sessions with identified, tied, or induced groups instead of random college students and see whether identity reverses the outcome.

REFERENCE

Ahn, T.K., Ostrom, E., Schmidt, D.,Walker, J., 2003. Trust in two-person games: game structures and linkages. In: Ostrom, E., Walker, J. (Eds.), Trust and Reciprocity. Interdisciplinary Lessons From Experimental Research. New York: Russell Sage Foundation, pp. 323–351.

Andreoni, J., Miller, J. (1993). "Rational cooperation in the finitely repeated prisoner's dilemma: Experimental evidence". Economic Journal 103, 570–585.

Andreoni, James and John H Miller, 2001. Analyzing Choice with Revealed Preference: Is Altruism Rational, Levine's Working Paper Archive, UCLA Department of Economics.

Ashraf, Nava, Iris Bohnet, and Nikita Piankov. 2006. ``Decomposing trust and trustworthiness.'' *Experimental Economics,* 9(3): 193-208.

Axelrod, R. (1984). "The Evolution of Cooperation". Free Press, New York.

Bendor, Jonathan, Dilip Mokherjee, and Debraj Ray. 2001. "Aspiration-Based Reinforcement Learning in Repeated Interaction Games: An Overview." International Game Theory Review, 3 (2/3,Jun-Sep): 159- 174.

Benoit, J. P., and V. Krishna. 1987. Mash equilibria of finitely repeated games. International Journal of Game Theory 16.

Boyd, Robert, Herbert Gintis, Samuel Bowles, Peter J. Richerson, 2003. The Evolution of Altruistic Punishment. Proceedings of the National Academy of Sciences of the United States of America Volume 100(6), 3531-3535.

Bolton, Gary E., and Axel Ockenfels. 2000. ERC: A theory of equity, reciprocity, and competition. *American Economic Review* 90 (1): 166-93.

Budescu, D.V., A. Rapoport, and R. Suleiman 1990 Resource dilemmas with environmental uncertainty and asymmetric players. *European Journal of Social Psychology* 20(6):475-487.

Budescu V. David, Amnon Rapoport, and Ramzi Suleiman, 1995. Common Pool Resource Dilemmas under Uncertainty: Qualitative Tests of Equilibrium Solutions Games and Economic Behavior 10: 171-201.

Capra, C. Mónica, Kelli Lanier, and Shireen Meer, 2008. Attitudinal and Behavioral measures of trust: a New Comparison, working paper

Chai, Sun-Ki 2001. Choosing the Identity A General Model of Preference and Belief Formation Ann Arbor: University of Michigan Press.

Chai, Sun-Ki, Kyle Hampton, Dolgrosuren Dorj, Ming Liu 2008a. Grid-Group Cultural Theory and Behavior in Computer-Mediated Experiments. Working paper.

Chai, Sun-Ki, Kyle Hampton, Dolgorsuren Dorj and Ming Liu 2008b. *Role-assignment Algorithm: Experimental Study of Cooperation in Public Good Games and Coordination in Assurance Games*.

Chai, Sun-Ki, Dolgrosuren Dorj, Ming Liu 2007. Endogenous Shifts Over Time in Patterns of Contributions in Public Good Games. Working paper.

Charness, Gary, and Matthew Rabin. 2002. Understanding social preferences with simple tests. *Quarterly Journal of Economics* 117 (3): 817-69.

Croson, Rachel, 2007. Theories of commitment, altrusim and reciprocity: evidence from linear public good games. Economic Inquiry, 45 (2): 199-216.

Chuah, Swee-Hoon, Robert Hoffmann, Martin Jones and Geoffrey Williams. ``An economic anatomy of culture: Attitudes and behaviour in inter- and intra-national ultimatum game experiments.'' *Journal of Economic Psychology*, 30 (2009), 732–744.

Dale, Donald J. 2004. Charitable Lottery Structure and Fund Raising: Theory and Evidence. Experimental Economics 7(3 / October).

Darley, J.M., and B. Latané 1968 Bystander intervention in emergencies: Diffusion of responsibility. *Journal of Personality and Social Psychology* 8:377-383.

Danielson, A., and H. Holm, 2007. Do you trust your brethren? Eliciting trust attitudes and trust behavior in a Tanzanian congregation, Journal of Economic Behavior & Organization, 62: 255-271.

Dickinson, David L. 1998. The voluntary contributions mechanism with uncertain group payoffs. Journal of Economic Behavior and Organization 35(4/ 1 May), 517-533.

Dufwenberg, Martin, and Georg Kirchsteiger, 1998. A Theory of Sequential Reciprocity, CentER Discussion paper No. 9837, Tilburg University.

Eichberger, Jurgen and David Kelsey, 2002. Strategic Complements, Substitutes, and Ambiguity: The Implications for Public Goods. Journal of Economic Theory 106, 436-466.

Falk, A., and Fischbacher, U. 1998. A theory of reciprocity. Institute of Empirical Research in Economics. University of Zurich. Working Paper No.6.

Falk, A., Fehr, E., and Fischbacher, U. (2005), Driving forces behind informal sanctions. *Econometrica* 73: 2017-2030.

Fehr, Ernst, and Klaus M. Schmidt. 1999. A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics* 114 (3): 817-68.

Fehr, E., and S. Gachter, 2000. Cooperation and Punishment. American Economic Review, 90 (4): 980-994.

Fehr, E., U. Fischbacher, B.v. Rosenbladt, J. Schupp, and G. Wagner, 2002. A nation-wide laboratory -Examining trust and trustworthiness by integrating experiments in representative surveys. Schmollers Jahrbuch, 122: 519-542.

Fischbacher, U., Gächter, S., & Fehr, E. (2001). Are people conditionally cooperative? Evidence from public goods experiment. Economics Letters, 71, 397–404.

Fischbacher, Urs. 2007. z-Tree: Zurich Toolbox for Ready-made Economic Experiments, forthcoming Experimental Economics, Experimental Economics 10(2), 171-178.

Fleishman, J.A. 1980 Collective action as helping behavior: Effects of responsibility diffusion on contributions to a public good. *Journal of Personality and Social Psychology* 38(4):629-637.

Gradstein, Mark , Shmuel Nitzan ,and Steven Slutsky,1993. Private provision of public goods under price uncertainty. Social Choice and Welfare 10(4 /October)

Goette Lorenz, David Huffman, and Stephan Meier 2006.The Impact of Group Membership on Cooperation and Norm Enforcement: Evidence Using Random Assignment to Real Social Groups. American Economic Review, 96: 212-216

Gächter, S., B. Herrmann, and C. Thöni, 2004. Trust, voluntary cooperation, and socio-economic background: survey and experimental evidence. Journal of Economic Behavior and Organization 55: 505-531.

Gächter, S., Herrmann, B., 2003. Norms of cooperation among urban and rural dwellers. Experimental evidence from Russia. Mimeo, University of St. Gallen.

Glaeser, E. D. Laibson, J. Scheinkman and C. Soutter, 2000. Measuring trust. Quarterly Journal of Economics, 115: 811–846.

Gustafsson, M, A. Biel, and T.Gaerling. 1999a. Outcome-desirability bias in resource management problems. Thinking and Reasoning 5 (4), 327-337.

Gustafsson, M, A. Biel, and T.Gaerling. 1999b. Overharvesting of resources of unknown size. *Acta Psychologica* 103:47-64.

Hine, D. W., and Gifford, R. (1996). Individual restraint and group efficiency in commons dilemmas: The effects of uncertainty and risk-seeking. Journal of Applied Social Psychology, 26, 993-1009.

Isaac, R. M., J.Walker, and S. Thomas. 1984. Divergent evidence on free-riding: An experimental examination of possible explanations. Public Choice 43 (2): 113-49.

Isaac, Mark R., Kenneth F. McCue, and Charles R. Plott, 1985. Public goods provision in an experimental environment, Journal of Public Economics, Elsevier, 26(1): 51-74.

Kahn, L.M., Murnighan, J.K. (1993). "Conjecture, uncertainty, and cooperation in prisoner's dilemma games". Journal of Economic Behavior and Organization 22, 91–117.

Keenan, Donald C., Iltae Kim, and Warren Jr. Ronald S., (2006) The Private Provision of Public Goods under Uncertainty: A Symmetric-Equilibrium Approach. Journal of Public Economic Theory 8 (5): 863-873.

Kreps, D., Milgrom, P., Roberts, J.,Wilson, R. (1982). "Rational cooperation in the finitely repeated prisoner's dilemma". Journal of Economic Theory 27, 245–252.

Kurzban, Robert and Daniel Houser 2005, Experiments investigating cooperative types in humans: A complement to evolutionary theory and simulations PNAS 102(5): 1803-1807.

Liebrand,W.B.G., 1984. The effect of social motives, communication and group sizes on behavior in an *n*-person multi stage mixed motive game. European Journal of Social Psychology 14, 239–264.

Ledyard, John O., 1995. Public goods: a survey of experimental research. In: Hagel, J., Roth, A. (Eds.), The Handbook of Experimental Economics. pp. 111-194. Princeton University Press

Ma, Leanne, Katerina Sherstyuk, Malcolm Dowling, Olivier Hill, 2002. Altruism and voluntary provision of public goods. Economics Bulletin, 3, 1−8.

Menezes, F., P. Monteiro and A. Temimi, 2001. Private provision of discrete public goods with incomplete information, Journal of Mathematical Economics 35, 493-514.

Murnighan, J.K., Roth, A.E. (1983). "Expecting continued play in prisoner's dilemma games". Journal of Conflict Resolution 27, 279–300.

Nitzan, S. and R. Romano, 1990. Private provision of a discrete public good with uncertain cost, Journal of Public Economics 42 (3), 357-370.

Ones, U., Putterman, L., 2007. The Ecology of Collective Action: A Public Goods and Sanctions Experiment with Controlled Group Formation. J. Econ. Behav. Organ. 62 (4), 495-521.

Offerman, T., Sonnemans, J., Schram, A., 1996. Value orientations, expectations and voluntary
contributions in public goods. Economic Journal 106, 817–845.

Ostrom, Elinor 2000. Collective Action and the Evolution of Social Norms The Journal of Economic Perspectives, 14(3/Summer): 137-158

Palfrey, T. and Rosenthal, H., 1988. Private incentives and social dilemmas: the effects of incomplete info Journal of Public Economics, 35(April/3): 309-332.

Palfrey, T., Rosenthal, H., 1991. Testing game theoretic models of free-riding:
new evidence on probability bias and learning. In: Palfrey, T. (Ed.), Laboratory Research and Political Economy. University of Michigan Press, Michigan, pp. 239-268.

Rabin, M., 1993. Incorporating Fairness into Game Theory and Economics. American Economic Review 83(5), 1281-1302.

Rapoport, A., Chammah, A. (1965). "Prisoner's Dilemma". University of Michigan Press, Ann Arbor.

Rapoport, A., Budescu, D. V., Suleiman, R., & Weg, B. (1992). Social dilemmas with uniformly distributed resources. In W. G. B. Liebrand, D. M. Messick, & H. A. M. Wilke (Eds.), Social dilemmas: Theoretical issues and research findings (pp. 43-57). New York: Pergamon Press.

Roth, A.E. (1988). "Laboratory experimentation in economics: A methodological overview". Economic Journal 98, 974–1031.

Roth, A.E., and Murnighan, J.K. (1983). "Equilibrium behavior and repeated play of the prisoner's dilemma". Journal of Mathematical Psychology 17, 189–198.

Roch, S.G., and C.D. Samuelson. 1997. Effects of environmental uncertainty and social value orientation in resource dilemmas. *Organizational Behavior and Human Decision Processes* 70(3): 221-235.

Sethi, Rajiv and E. Somanathan. 2006. A Simple Model of Collective Action. Economic Development and Cultural Change 54(3): 725-747.

Selten, R., Stoecker, R. (1986). "End behavior in sequences of finite prisoner's dilemma supergames". Journal of Economic Behavior and Organization 7, 47–70.

Sherif, Muzafer; Harvey, O. J.; White, B. Jack; Hood, William R. and Sherif, Carolyn W., 1961. Intergroup conflict and cooperation: The robbers cave experiment. Norman, OK: University of Oklahoma Book Exchange.

Sonnemans, J., Schram, A., Offerman, T., 1998. Public good provision and public bad prevention: the effect of framing. Journal of Economic Behavior and Organization 34, 143–161.

Suleiman, Ramzi 1997. Provision of step-level public goods under uncertainty: a theoretical Analysis. Rationality and Society 9(2): 163-187

Suleiman, R. and A. Rapoport (1989). Environmental and social uncertainty in the single-trial resource dilemma. Acta Psychologica, 68, 99-112.

Tajfel, H. (1978). Differentiation between social groups: Studies in the social psychology of intergroup relations. London: Academic Press.

Van Dijk, F., van Winden, F., 1997. Dynamics of social ties and public good provision. Journal of Public Economics 64, 323–341.

Van Dijk, E., H. Wilke, M. Wilke, and L. Metman 1999 What information do we use in social dilemmas? Environmental uncertainty and the employment of coordination rules. *Journal of Experimental Social Psychology* 35(2):109-135.

Van Dijk, F., Sonnemans, J., van Winden, F., 2002. Social ties in a public good experiment. Journal of Public Economics 85, 275–299.

Wit, A., and H. Wilke. 1988 Subordinates' endorsement of an allocating leader in a commons dilemma: An equity theoretical approach. *Journal of Economic Psychology* 9(2):151-168.

Yamagishi, Toshio, Nobuhito Jin, and Toko Kiyonari, 1999. Bounded generalized reciprocity: ingroup boasting and ingroup favoritism. Advances in Group Processes, 16, 161-197.

Yamagishi, Toshio. 1988. Exit from the Group as an Individualistic Solution to the Public Good Problem in the United States and Japan. Journal of Experimental Social Psychology 24 (6), 530-542.

Table 1. Summary of experimental sessions

	Treatments	Date	Time	Number of subjects	Session code
A:	Stochastic in public VCM, standard VCM				
		12/07/2009	11am-12:10pm	16	1
		12/10/2009	1pm-2:30pm	12	5
		12/11/2009	11am-12:10pm	16	6
		12/15/2009	3pm-4:10pm	16	8
B:	Non-stochastic VCM, standard VCM				
		12/07/2009	1pm-2:30pm	16	2
		12/09/2009	11am-12:10pm	16	3
		12/10/2009	11am-12:10pm	16	4
		12/11/2009	1pm-2:30pm	16	7
total				124	

Table 3. Average contributions

treatment session	Stochastic S	Non-stochastic N	Regular-after-stochastic RS	Regular-after-non-stochastic RN
1 or 2	**0.63**	**0.96**	**0.33**	**0.15**
	0.49	0.19	0.47	0.36
5 or 3	**0.63**	**0.66**	**0.43**	**0.51**
	0.49	0.48	0.5	0.5
6 or 4	**0.78**	**0.76**	**0.31**	**0.38**
	0.41	0.43	0.46	0.49
8 or 7	**0.64**	**0.86**	**0.3**	**0.5**
	0.48	0.35	0.46	0.5
total	**0.67**	**0.81**	**0.34**	**0.39**
	0.47	0.39	0.47	0.49

	p*-value	
Ho: S=N	0.0814	
Ho: S=RS	0.0202	>
Ho: S=RN	0.0202	>
Ho: N=RS	0.0209	>
Ho: N=RN	0.0209	>
Ho: RS=RN	0.3865	

* Wilcoxon-Mann-Whitney test compares averages per session across treatments

Table 4. Pearson correlations, contributions

treatment	Stochastic	Non-stochastic	Regular after stochastic	Regular after-non-stochastic
Pearson's r **gridscore**	0.0674	0.015	0.1027*	0.0669
signif-t (2-tailed)	0.099	0.704	0.0118	0.0909
N	600	640	600	640
Pearson's r **groupscore**	0.1677*	0.1695*	0.0256	0.0765
signif-t (2-tailed)	0	0	0.5319	0.0531
N	600	640	600	640
Pearson's r **risktype**	-0.0079	0.2151*	-0.0751	-0.0952*
signif-t (2-tailed)	0.8478	0	0.0659	0.0159
N	600	640	600	640
	68.2	80.7	34.7	38.6

3-risk-averse, 2-risk-neitral, 1-risk-lover

* significant at 5 percent level

Table 5. Distribution of risk types across sessions

session	treatment	risk-lovers	risk-neutral	risk-averse	total	risk-lovers,%	risk-neutral,%	risk-averse,%
1	1	4	4	8	16	25.0	25.0	50.0
2	2	0	2	14	16	0.0	12.5	87.5
3	2	3	3	10	16	18.8	18.8	62.5
4	2	1	2	13	16	6.3	12.5	81.3
5	1	3	2	7	12	25.0	16.7	58.3
6	1	3	0	13	16	18.8	0.0	81.3
7	2	2	2	12	16	12.5	12.5	75.0
8	1	2	1	13	16	12.5	6.3	81.3
total		18	16	90	124	14.5	12.9	72.6

Distribution of risk types across treatments

treatment	risk-lovers	risk-neutral	risk-averse	total	risk-lovers,%	risk-neutral,%	risk-averse,%
Stochastic	1	12	7	41	60	20.0	11.7	68.3
Non-stochastic	2	6	9	49	64	9.4	14.1	76.6

1-stochastic, 2-non-stochastic

Table 6. Groupness and gridness of behavioral types

	group score		grid score		group score	grid score
	1	2	1	2	overall pooled	
cooperator	0.53	0.50	0.46	0.41	0.50	0.46
free rider	0.46	0.40	0.41	0.38	0.44	0.39
institution-responsive	0.52	0.50	0.44	0.41	0.48	0.46
unclassified	0.34	0.43	0.48	0.57	0.41	0.50
				max	0.74	0.91
				min	0.15	0.05
				mean	0.49	0.43
					(0.11)	(0.18)

1-stochastic game, 2- non-stochastic game

Table 7 Behavioral types by action and composition

Treatment code	1	2	14	24
		Non-	Regular after	Regular after
Behavioral type	Stochastic	stochastic	stochastic	Non-stochastic
Mean contribution:	**0.67**	**0.81**	**0.34**	**0.39**
cooperator	0.89	0.94	0.77	0.83
free rider	0.31	0.25	0.19	0.09
institution-responsive	0.83	0.94	0.2	0.15
unclassified	0.37	0.4	0.67	0.63
Percent of cooperative actions:	**67.1**	**80.8**	**33.4**	**38.6**
cooperator	17.8	30.9	15.3	27.3
free rider	8.8	3.9	5.3	1.4
institution-responsive	38.7	44.1	9.5	6.9
unclassified	1.8	1.9	3.3	3
Composition:	**Number of**	**people**	**Percent**	
	60	64	100%	100%
cooperator	12	21	20	32.8
free rider	17	10	28.3	15.6
institution-responsive	28	30	46.7	46.9
unclassified	3	3	5	4.7

8. Percent of contributing actions by treatment and risk types

		risk-lover	risk-neutral	risk-averse
Stochastic	67.2	13.3	8.3	45.5
Non-stochastic	80.7	5.9	9.2	65.6
Regular after stochastic	33.5	8.2	3.8	21.5
Regular after non-stochastic	41.2	5	5.6	28

Table 9. Religion of participants

religion	code	number	%
Mormon	1	2	1.6
Christian	2	21	16.9
Catholic	3	13	10.5
Hindu	4	5	4.0
Buddhist	5	16	12.9
Muslim	6	10	8.1
No religion	7	8	6.5
Jewish	8	1	0.8
Government	9	1	0.8
none	0	41	33.1
missing values		6	4.8
		118	
total		124	100

Table 10. Mean times individuals contributed

mean/stdev session		rounds 1-10		rounds 11-20		all 20 rounds	
		S	N	RS	RN	S+RS	N+RN
	1	**6.67**	**9.63**	**4.42**	**2.4**	**10.2**	**11.13**
		2.55	1.26	2.61	2.01	4.26	2.53
	2	**6.82**	**7**	**6.38**	**6.31**	**11.45**	**12.47**
		2.99	2.88	2.77	2.87	5.5	5.17
	3	**7.81**	**8.64**	**4.08**	**6.1**	**10.88**	**13**
		2.48	1.98	2.54	3.67	4.32	5.22
	4	**6.44**	**8.56**	**3.43**	**6.15**	**9.44**	**13.56**
		3.2	2.53	1.91	3.16	4.21	5.37
total		**6.95**	**8.48**	**4.37**	**5.37**	**10.41**	**12.52**
		2.79	2.38	2.55	3.3	4.46	4.67

S-stochastic, N-non-stochastic, RS-regular after the stochastic, NS-regular after the non-stochastic

Mean contribution by risk types
Modified stochastic VCM

Mean contribution by risk types
Regular after stochastic VCM

Mean contribution by risk types
Modified non-stochastic VCM
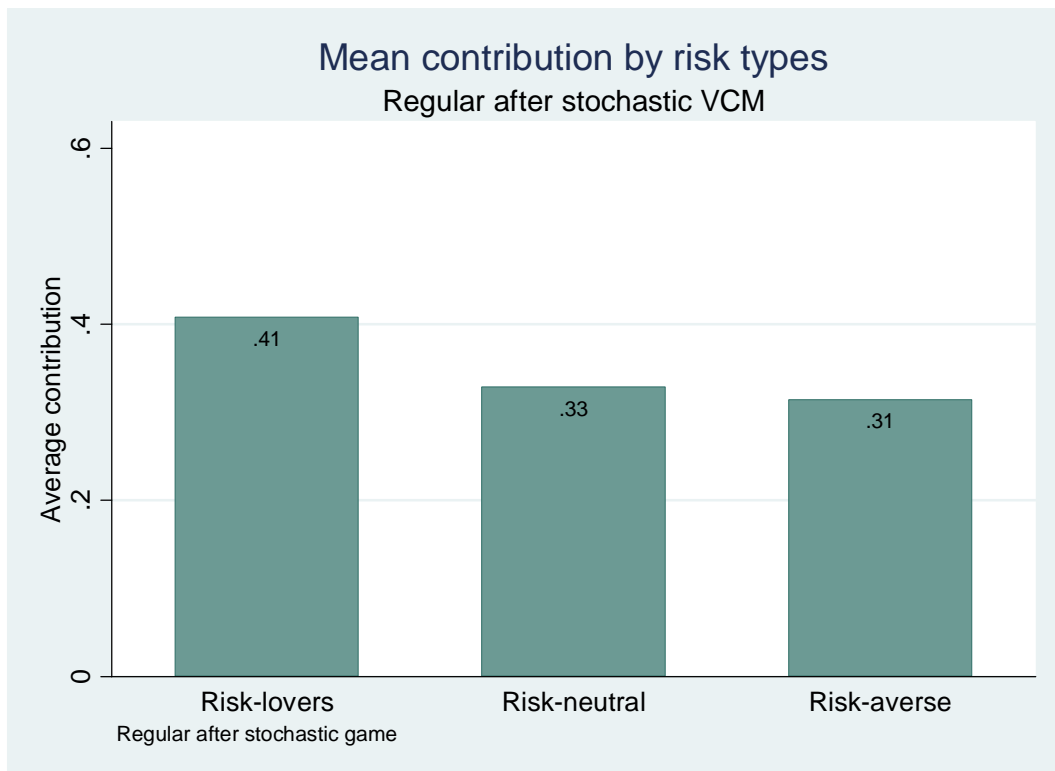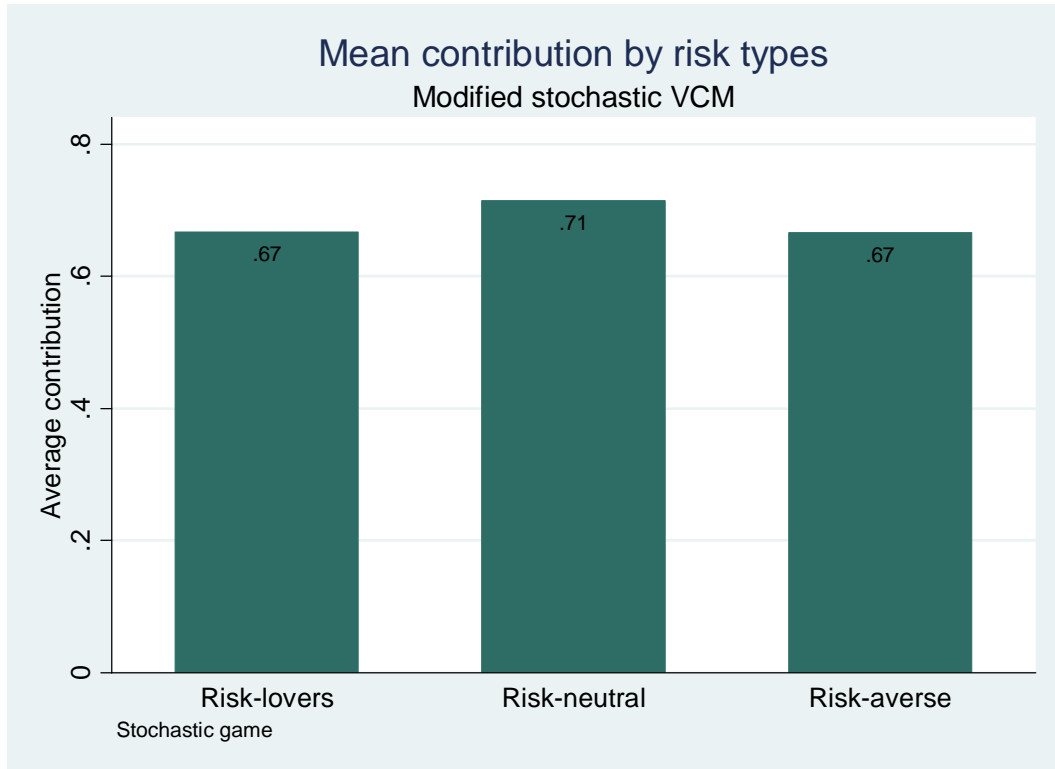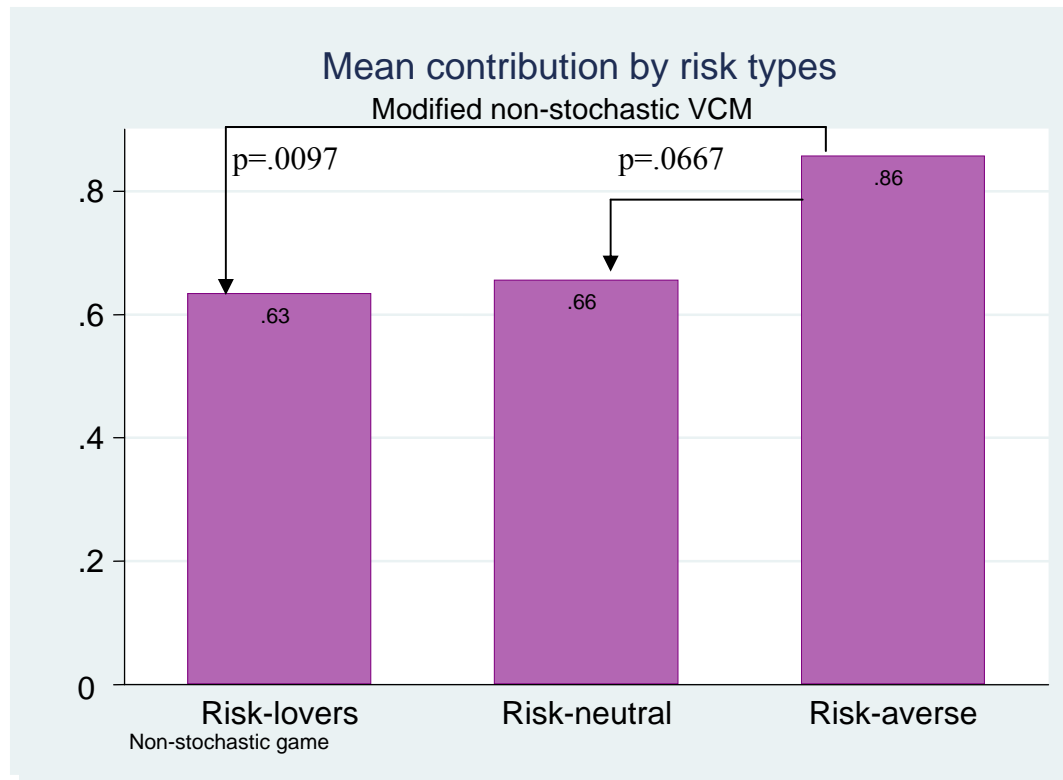
Risk-lovers<risk-averse p=0.097, risk-neutral<risk-averse p=0.0677 in the non-stochastic game
Wilcoxon-Mann-Whitney test that compares contributions across risk types in the 1st period only, if all periods included then p=0.

Mean contribution by risk types
Regular after non-stochastic VCM
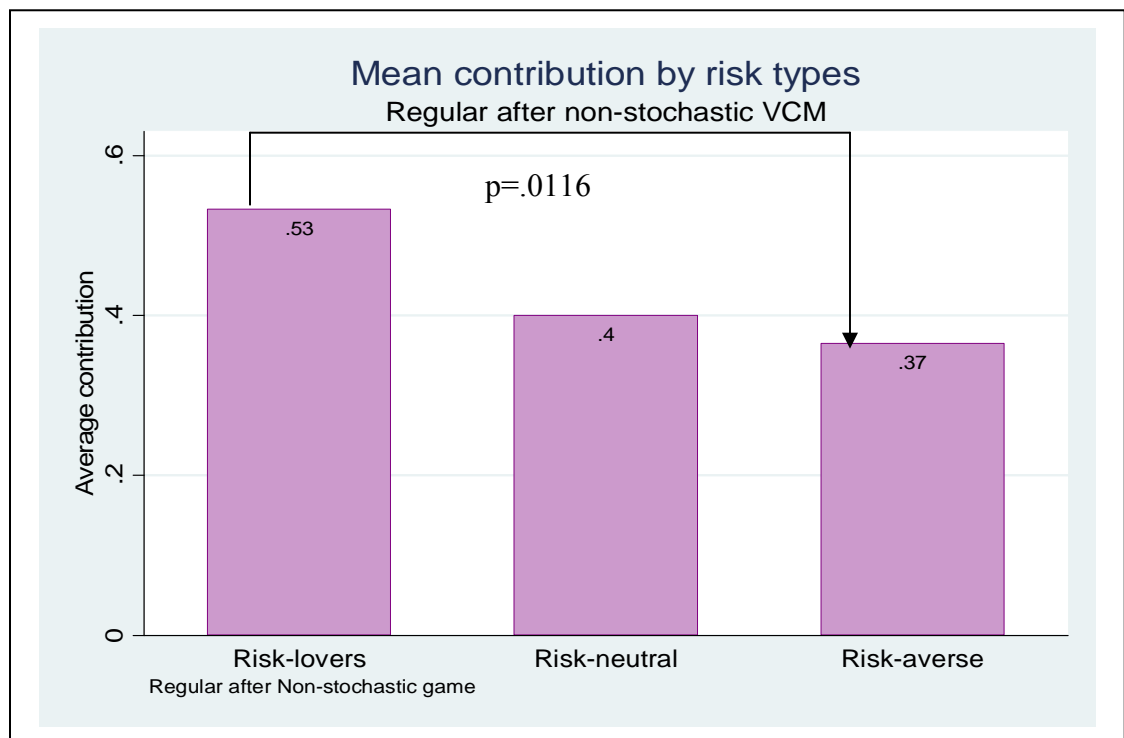
Mean contributions over time, Stochastic followed by Regular game, sessions 1, 5, 6, 8
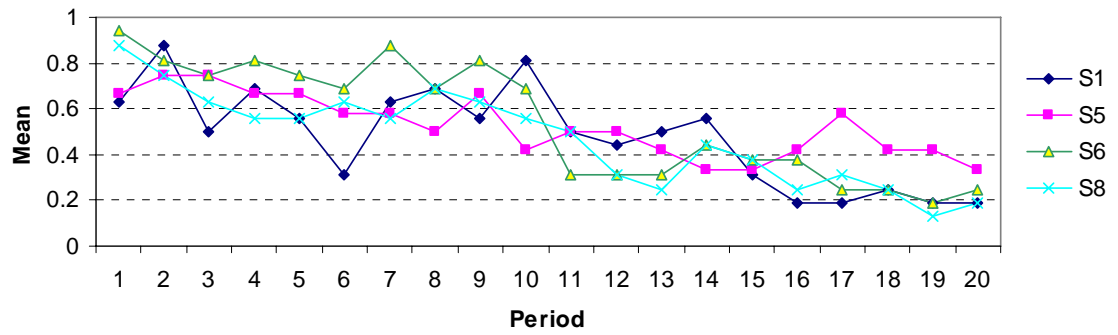
Mean contributions over time, Non-Stochastic followed by Regular game, sessions 2, 3, 4, 7

Appendix A (in-lab survey)

INFORMATION

Study Title: Impact of Cultural Factors in Human Performance
Study Investigator: Dr. Sun-Ki Chai
Department of Sociology, University of Hawaii, 2424 Maile Way, Saunders Hall 247, Honolulu, Hawaii 96822.   Phone: 956-7234. Email: sunki@hawaii.edu.

Purpose

This study is designed to examine the role of culture in group decision-making. In particular, we would like to examine from a scientific basis how people's cultural background influences the decisions that they make in groups. Your participation is voluntary. However, your participation is very important for the success of the study. You are encouraged to answer all questions as truthfully as possible. If you have questions regarding this research, please contact the study investigator at the number or email listed above.

Confidentiality

All information collected will be kept confidential to the extent allowed by law. The survey is anonymous, and does not contain any identifying information that can link you to your responses. The results of this research project may be published, but only the combined data from all participants will be made public, not data on individuals. However, the University of Hawaii's Committee on Human Studies has the authority to review research records.

Risks and Benefits of Participation

There will be no risks associated with participation in the survey. Participants will be given access to the aggregate results of the study data. Data generated from this study will contribute to better understanding of the role of culture in group decision.

Additional Inquiries

If you cannot obtain satisfactory answers to your questions or have comments or complaints about your treatment in this research project, contact: Committee on Human Studies, University of Hawaii, 2540 Maile Way, Honolulu, Hawaii 96822; Phone: 956-5007

_____

SURVEY QUESTIONS

Please say, for each of the following, how important it is in your life. Would you say...

	Very Important	Rather Important	Not Very Important	Not at all Important
1. Family	1	2	3	4
2. Friends	1	2	3	4
3. Religion	1	2	3	4

4. With which of these two statements do you tend to agree?

       1. Regardless of what the qualities and faults of one's parents are, one must always love and respect them
       2. One does not have the duty to respect and love parents who have not earned it by their behavior and attitudes

5. Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?
       1. Most people can be trusted
       2. Can't be too careful (have to be very careful)

Do you agree or disagree with the following statements?

	Agree	Neither	Disagree
6. When jobs are scarce, men should have more right to a job than women	1	2	3
7. When jobs are scarce, older people should be forced to retire from work early	1	2	3

8. Imagine two secretaries, of the same age, doing practically the same job. One finds out that the other earns considerably more than she does. The better paid secretary, however, is quicker, more efficient and more reliable at her job. In your opinion, is it fair or not fair that one secretary is paid more than the other?
       1. Fair
       2. Not fair

9. There is a lot of discussion about how business and industry should be managed. Which of these four statements comes closest to your opinion?
       1. The owners should run their business or appoint the managers
       2. The owners and the employees should participate in the selection of managers
       3. The government should be the owner and appoint the managers
       4. The employees should own the business and should elect the managers

10. People have different ideas about following instructions at work. Some say that one should follow one's superior's instructions even when one does not fully agree with them. Others say that one should follow one's superior's instructions only when one is convinced that they are right. With which of these two opinions do you agree?
       1. Should follow instructions
       2. Depends
       3. Must be convinced first

11. Do you think that a woman has to have children in order to be fulfilled or is this not necessary?
       1. Needs children
       2. Not necessary

The following items contain a list of various changes in our way of life that might take place in the near future. Please tell me for each one, if it were to happen, whether you think it would be a good thing, a bad thing, or don't you mind?

	Good	Don't mind	Bad
12. Less emphasis on money and material possessions	1	2	3

13. Less importance placed
on work in our lives   1   2   3

14. More emphasis on the
development of technology   1   2   3

15. Greater respect for authority   1   2   3

For the following questions, please place your views along the accompanying scale. 1 means you agree completely with the first statement; 10 means you agree completely with the second statement; and if your views fall somewhere in between, you can choose any number in between.

16.   1. Private ownership of business and industry should be increased
           10. Government ownership of business and industry should be increased

           1   2   3   4   5   6   7   8   9   10

17.   1. The government should take more responsibility to ensure that everyone is provided for
           10. People should take more responsibility to provide for themselves

           1   2   3   4   5   6   7   8   9   10

18. How important is God in your life? Please use this scale to indicate - 10 means very important and 1 means not at all important.

           1   2   3   4   5   6   7   8   9   10
           Not at all   Very

Please tell me for each of the following statements whether you think it can always be justified, never be justified, or something in between, using this card.

	Never Justifiable	**Always Justifiable**
19. Homosexuality	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	
20. Prostitution	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	
21. Abortion	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	
22. Divorce	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	

Post test questionnaire:

- Risk and Public Good Questions
    - In general, do you think you invested more or less money in the public investment than the people you were matched with?
    - In deciding upon how much to contribute to public investment, to what extent was did you take into consideration the public good (the benefit to others in your group of four), as opposed the expected benefit to yourself?
        - Only considered benefit to self
        - Mainly considered benefit to self, but not completely
        - Considered both benefit to self and to others about equally
        - Mainly considered benefit to others, but not completely
        - Only considered benefit to others
    - On a scale of one to ten (not just for the purposes of this experiment), do you consider yourself a person who is more interested in her/his own self-interest, or someone who is cares more about the public good?

1) completely self-interested
10) completely interested in the public good

    - On a scale of one to ten (not just for the purposes of this experiment), do you consider yourself a risk-taker, or someone who takes safety-first?

1) complete risk-taker
10) completely safety-first

- Alternative G/G Questions

Choosing 1 means you agree completely with the statement 1; Choosing 10 means you agree completely with the statement 10; and if your views fall somewhere in between, you can choose any number in between.

1. People should follow the rules of society
10. People should decide for themselves what to do

1. People should sacrifice their own interests for sake of the group
10. People should pursue their own interests as individuals

- National Questions
    - Of which country are you currently a citizen?
    - In which country do you currently have permanent residence?
    - In which country were you born?
    - In which country have you spent the largest portion of your life until now?
    - With which country do you identify yourself with the most strongly?
- Ethnicity Questions
    - Within your country, which, if any, religious group do you identify yourself?
    - Within your country, which, if any, linguistic group do you identify yourself?
    - Within your country, which, if any, regional group do you identify yourself?
    - Which of the above, if any, do you identify most strongly?

- Demographic Questions
  - Please specify if you are
    - Male
    - Female
  - What is your current academic grade level?
    - Freshman
    - Sophomore
    - Junior
    - Senior
    - Graduate – Masters
    - Graduate – PhD, JD, MD
    - Unclassified
  - How would you describe the locality where you grew up (if you grew up in multiple localities, please answer according to the mean or typical experience for you).
    - Rural area/Countryside
    - Town (population of less than 100,000)
    - Large City (population of more than 100,000)
  - How long have you been in the USA in years?
- Questions about Experiment
  - How many times have you participated in computer-based experiments before?
  - How difficult was it to understand the procedures of the experiment?
  - Do you have any suggestions for improving the experiment?

AGREEMENT TO PARTICIPATE IN EXPERIMENTAL MARKETS
Principal investigators: **Sun-Ki Chai**, Department of Sociology,
University of Hawaii, phone (808)-956- 7234
Ekaterina Sherstyuk, Department of Economics,
University of Hawaii, phone (808)-956-7851
Min-Sun Kim, Department of Speech,
University of Hawaii, phone (808)-956-8317

This is a research experiment in economics of decision-making. The experiment has been explained to me in detail, and I have been familiarized with experimental instructions. I understand that the experiment is voluntary, and participation is anonymous. The data collected on my decisions will be anonymous and will not put me at any risk. Although there are no risks to me, I will be paid $5 participation fee, plus whatever money I make during the experiment. There are benefits to the society from this experiment in studying economics of decision making.

I certify that I have been told of the possible risks involved in this project, that I have been given satisfactory answers to my inquiries concerning project procedures and other matters and that I have been advised that I am free to withdraw my consent and to discontinue participation in the project at any time without prejudice. I understand that the experiment will take at most 2 hours.

I herewith give my consent to participate in this project with the understanding that such project does not waive any of my legal rights; nor does it release the principal investigator or the institution or any employee or agent thereof from liability for negligence.

Signature of participant: _____

Date: _____

If you cannot obtain satisfactory answers to your questions from the Principal Investigator, or have comments or complaints about your treatment in this study, contact: Committee on Human Studies, University of Hawaii, 2540 Maile Way, Honolulu, HI 96822. Phone: (808)-956-5007.

INSTRUCTIONS   ``*for the risk measure''*

This is an experiment in decision making. You will be asked to make a series of decisions. The amount of cash you earn is determined by the choices you make.

You will be presented with a series of decision tasks. Your total earnings will be the sum of what you earn from all the tasks in addition to your $5 participation fee. All your earnings will be paid in cash in private at the end of the experiment.

CHOICE BETWEEN OPTION A AND B

In the first part of the experiment you will be asked to make a choice between two options - Option A or Option B – 10 times. The options differ in the following way:

OPTION A: always pays $2.50 in cash.

OPTION B: has two possible payoffs: HIGH Payoff= $5.00 or LOW Payoff= $.0

Whether Option B pays the HIGH or LOW Payoff will be randomly determined by the computer, with a predetermined chance each of the HIGH or LOW payoff.

For instance, you will be shown the following two options:

	OPTION A	OPTION B	
payoff-->	$2.50	$5 (60%)	or $0 (40%)

In the above example, choosing Option A pays you $2.50 no matter what. Choosing Option B will pay $5 to you 60% of the time, and $0 to you 40% of the time.

EARNING IN TASK 1

The first part of the today's experiment will begin with your making choices between Options A and B in 10 different situations (numbered Situation 1 to Situation 10), each with a different set of odds for Option B. Even though you will be asked to make a choice between Option A and Option B for 10 different situations, your actual earnings in Task 1 will depend on your choice in only ONE of those situations. At the end of the experiment computer randomly selects one situation out of ten. Then computer will randomly determine whether the payoff from Option B is HIGH or LOW, according to the specific

odds for each associated with that situation. If you chose Option A for that situation, your payoff will always be $2.50.

The computer will generate two random numbers, the first to determine the SITUATION that will apply to your payoff, and the second to determine the PAYOFF for OPTION B. The computer first generates a number between 1 and 10 to determine the Situation that applies, with each situation having a 10% chance of being chosen. If the number generated is 6, this means that Situation 6 will be used to determine your earnings for Task 1.

Next the computer will draw a random number between 0 and 1. If you chose Option A you will get $2.5. Let us say that the situation chosen is 6. If you chose Option B, then 60% of the time you will earn $5 while 40% of the time you will earn $0.

ARE THERE ANY QUESTIONS? Please proceed to task 1 on your computer screen.

INSTRUCTIONS_1   TASK 2   `` *for the stochastic game* ''

Now we will proceed with TASK 2. The instructions are simple, and if you follow them carefully and make good decisions you may earn a considerable amount of money and/or help others assigned to work with you to earn money. During the TASK 2, all units of account will be in experimental tokens. At the end of the experiment all tokens you collect will be converted into dollars at the exchange rate of 25 cents per token.

You are NOT allowed to communicate with any other participant. From this point onwards, you will be referred to by your participant ID number. Your ID number will appear at the left top corner of the screen.

GROUP
You will be in a group consisting of four members. The other members in your group will be actual people sitting in this room, but you will not be told which people you are interacting with. The experiment will last for ten periods. The people in your group will CHANGE RANDOMLY from period to period. Thus, you will be with a DIFFERENT group of people from period to period, and you will not be told who they are.

DECISIONS
Decisions will be made in a number of rounds (periods). At the beginning of each period you will each be given ONE token to invest. You will be choosing between two investment opportunities: Group Exchange and Individual Exchange.

GROUP EXCHANGE
Group Exchange is like a pooled investment of money by members of the group in a common project. What YOU earn from Group Exchange will depend on the total number of tokens that YOU AND THE OTHER THREE MEMBERS of your group invest in Group Exchange. The more a group member invests in Group Exchange, the more the other members of the group, and possibly the member, earn.   The total number of tokens invested in Group Exchange by all the members is called the Group Investment, while the total number of tokens generated by the investment is called the Group Benefit. The tokens will be distributed equally among members of the group; therefore each member will receive one fourth of the Group Benefit.

There is an element of probability regarding return from GROUP exchange. Any member's investment of 1 token in Group Exchange will add either 2 tokens or 8 tokens to the Group Benefit as a result, each with a 50% probability. In other words, each member of the group will receive either TWO (2) or HALF (0.5) times the total number of all tokens invested, and both outcomes are EQUALLY LIKELY.   In each period, the computer will pick up random number which determines whether the return from Group Exchange is HIGH (2) or LOW (0.5).   THIS MEANS THAT THE AVERAGE RETURN EACH GROUP MEMBER CAN EXPECT FROM GROUP EXCHANGE IS 2 X 50% + 0.5 X 50% = 1.25 TIMES THE TOTAL NUMBER OF TOKENS INVESTED.

INDIVIDUAL EXCHANGE
Every token you invest in Individual Exchange will earn you a return of one token, and nobody else in the group will gain anything from your investment. Individual exchange means you keep all your investment to yourself. Hence, one major

difference between Group and Individual exchange is that by investing in Group exchange, you always benefit the other members of your group. By investing in Individual exchange, you only benefit yourself.

TOTAL EARNINGS

Your task in each period is to decide either to invest your token in Group Exchange or in Individual Exchange. You must invest your tokens in one kind of exchange or another.

YOUR TOTAL EARNINGS in a given period will be equal to your earnings from the Group exchange, plus your earnings from Individual exchange. Your total earnings for this task will be equal to the sum of earnings across all 10 periods.

You must make your investment decisions WITHOUT knowing what the other players in your group are deciding. You are not to reveal your investment decision to anyone. When you have made your investment decisions, you will click on the red "OK" button.

The process is best explained by a number of examples.

Example 1: Suppose that each member of your group (including yourself) invests their token in Group Exchange. This makes a total of 4 tokens in Group Exchange. If the computer randomly picks HIGH return, then you and the other members in your group will each receive 2 x 4 = 8 tokens in that period. If, on the other hand, the computer randomly picks LOW return, then each member will receive 0.5 x 4 = 2 tokens in that period, all from Group Exchange.

Example 2: Suppose every member of the group (including yourself) invests their token in Individual Exchange. Then each of you would receive 1 token in that period, all from Individual Exchange.

Example 3: Suppose that you invest your token in Group Exchange, but the each of the three other members invest their token in Individual Exchange. If the computer selects LOW return, then you, and everyone else in the group, would get a return of 0.5 x 1 = 0.5 from Group Exchange. However, the others would receive 1 token from Individual Exchange, for total of (0.5 x 1) + 1 = 1.5 tokens, while you would not receive anything from Individual Exchange and end up with only a total of 0.5 tokens for that period. If the computer selects HIGH return, then you would end up with 2 x 1 = 2 tokens for that period, while each of the others would receive (2 x 1) + 1 = 3 tokens.

Example 4: Suppose that you decided to invest your token in Individual Exchange, and the three other members invest their tokens in Group Exchange. If the computer selects HIGH return, then each member's earnings from Group Exchange would be 2 x 3 = 6 tokens. This includes you, even though you did not invest anything in Group Exchange. However, you would also receive 1 token from Individual Exchange, while the others would not, thus you would receive a total of (2 x 3) + 1 = 7 tokens in that period, while the others would only receive 6. If the computer selects LOW return from Group Exchange, then you will receive (0.5 x 3) + 1 = 2.5 tokens in the period, while the others would receive 1.5 tokens apiece.

Example 5: Suppose that you and one other member of the group decide to invest your tokens in Group Exchange, while the other two invest their tokens in Individual Exchange. If the computer selects HIGH return, then you and the other member who invested in group exchange will each receive (2 x 2) = 4 tokens, while the other two members will receive (2 x 2) + 1 = 5 tokens each. If the computer selects LOW return, then you and the other member will each receive (0.5 x 2) = 1 token, while the other two members will receive (0.5 x 2) + 1 = 2 tokens apiece.

As you can see, every token invested in Group Exchange will earn either half or twice of a token for EVERY member of the group, not just the person who invested it. It does not matter who invests tokens in the group exchange. Everyone will get a return from every token invested — whether they invest in the group exchange or not. HENCE EVERY TOKEN A MEMBER INVESTS IN GROUP EXCHANGE BENEFITS THE OTHER MEMBERS, WHILE INVESTING IN INDIVIDUAL EXCHANGE DOES NOT.

The table below shows the total Group Benefit, as well as the benefit to each member for each level of Group Investment by the members.

RETURNS FROM THE GROUP EXCHANGE

TOTAL GROUP INVESTMENT	TOTAL GROUP BENEFIT (AND TO EACH MEMBER) if return is LOW (0.5)	TOTAL GROUP BENEFIT (AND TO EACH MEMBER) if return is HIGH (2)
0	0 (0)	0 (0)
1	2 (0.5)	8 (2)
2	4 (1)	16 (4)
3	6 (1.5)	24 (6)
4	8 (2)	32 (8)

At the end of the decision period, you will be shown the results, including the total number of tokens invested in Group Exchange, whether the return from Group Exchange is HIGH or LOW, your payoff from each kind of exchange, and your total payoff.

Please turn to your computer screens now. Go through the review questions on your computer screen and fill in the blank lines with the values you think are correct.

At the beginning we will run four practice-period experiments to get familiar with the rules. It will NOT count towards your earnings.

ARE THERE ANY QUESTIONS?

INSTRUCTIONS_2   TASK 2   ``*for the non-stochastic game''*

Now we will proceed with TASK 2. The instructions are simple, and if you follow them carefully and make good decisions you may earn a considerable amount of money and/or help others assigned to work with you to earn money. During the TASK 2, all units of account will be in experimental tokens. At the end of the experiment all tokens you collect will be converted into dollars at the exchange rate of 25 cents per token.

You are NOT allowed to communicate with any other participant. From this point onwards, you will be referred to by your participant ID number. Your ID number will appear at the left top corner of the screen.

GROUP

You will be in a group consisting of four members. The other members in your group will be actual people sitting in this room, but you will not be told which people you are interacting with. The experiment will last for ten periods. The people in your group will CHANGE RANDOMLY from period to period. Thus, you will be with a DIFFERENT group of people from period to period, and you will not be told who they are.

DECISIONS

Decisions will be made in a number of rounds (periods). At the beginning of each period you will each be given ONE token to invest. You will be choosing between two investment opportunities: Group Exchange and Individual Exchange.

GROUP EXCHANGE

Group Exchange is like a pooled investment of money by members of the group in a common project. What YOU earn from Group Exchange will depend on the total number of tokens that YOU AND THE OTHER THREE MEMBERS of your group invest in Group Exchange. The more a group member invests in Group Exchange, the more the other members of the group, and possibly the member, earn.   The total number of tokens invested in Group Exchange by all the members is called the Group Investment, while the total number of tokens generated by the investment is called the Group Benefit. The tokens will be distributed equally among members of the group; therefore each member will receive one fourth of the Group Benefit.

Any member's investment of 1 token in Group Exchange will add 5 tokens to the Group Benefit as a result. In other words, each member of the group will receive 1.25 times the total number of all tokens invested.

INDIVIDUAL EXCHANGE

Every token you invest in Individual Exchange will earn you a return of one token, and nobody else in the group will gain anything from your investment. Individual exchange means you keep all your investment to yourself. Hence, one major difference between Group and Individual exchange is that by investing in Group exchange, you always benefit the other members of your group. By investing in Individual exchange, you only benefit yourself.

TOTAL EARNINGS

Your task in each period is to decide either to invest your token in Group Exchange or in Individual Exchange. You must invest your tokens in one kind of exchange or another.

YOUR TOTAL EARNINGS in a given period will be equal to your earnings from the Group exchange, plus your earnings from Individual exchange. Your total earnings for this task will be equal to the sum of earnings across all 10 periods.
You must make your investment decisions WITHOUT knowing what the other players in your group are deciding. You are not to reveal your investment decision to anyone. When you have made your investment decisions, you will click on the red "OK" button.

The process is best explained by a number of examples.

Example 1: Suppose that each member of your group (including yourself) invests their token in Group Exchange. This makes a total of 4 tokens in Group Exchange. Each of you and the other members in your group will each receive 1.25 x 4 = 5 tokens in that period.

Example 2: Suppose every member of the group (including yourself) invests their token in Individual Exchange. Then each of you would receive 1 token in that period, all from Individual Exchange.

Example 3: Suppose that you invest your token in Group Exchange, but the each of the three other members invest their tokens in Individual Exchange. Then you, and everyone else in the group, would get a return of 1.25 x 1 = 1.25 from Group Exchange.   However, the other members would also receive 1 token from Individual Exchange for a total return of (1.25 x 1) + 1 = 2.25 tokens, while your total return would be 1.25 tokens.

Example 4: Suppose that you decided to invest your token in Individual Exchange, and the three other members invested their tokens in Group Exchange. Then each member's earnings from Group Exchange would be 1.25 x 3 = 3.75 tokens. This includes you, even though you did not invest anything in Group Exchange. However, you would also receive either 1 token from Individual Exchange, while the others would not, thus you would receive a total of (1.25 x 3) + 1 = 4.75 tokens in that period, while the others would only receive 3.75.

Example 5: Suppose that you and one other member of the group decide to invest your tokens in Group Exchange, while the other two invest their tokens in Individual Exchange. Then you and the other member who invested in group exchange will each receive (1.25 x 2) = 2.5 tokens. On the other hand the other two members will receive (1.25 x 2) + 1 = 3.5 tokens each.

As you can see, every token invested in Group Exchange will earn 1.25 tokens for EVERY member of the group, not just the person who invested it. It does not matter who invests tokens in the group exchange. Everyone will get a return from every token invested — whether they invest in the group exchange or not. HENCE EVERY TOKEN A MEMBER INVESTS IN GROUP EXCHANGE BENEFITS THE OTHER MEMBERS, WHILE INVESTING IN INDIVIDUAL EXCHANGE DOES NOT.

The table below shows the total Group Benefit, as well as the benefit to each member for each level of Group Investment by the members.

RETURNS FROM THE GROUP EXCHANGE

TOTAL GROUP INVESTMENT BY YOUR GROUP	TOTAL GROUP BENEFIT (AND TO EACH MEMBER)
0	0
1	5 (1.25)
2	10 (2.5)
3	15 (3.75)
4	20 (5)

At the end of the decision period, you will be shown the results, including the total number of tokens invested in Group Exchange, your payoff from each kind of exchange, and your total payoff.

Please turn to your computer screens now. Go through the review questions on your computer screen and fill in the blank lines with the values you think are correct.

At the beginning we will run four practice-period experiments to get familiar with the rules. It will NOT count towards your earnings.

ARE THERE ANY QUESTIONS?

INSTRUCTIONS   TASK 2 continues   ``*for the regular game''*

TASK

In this part of the experiment, as in the previous part, you will allocate your money (1 token) between Group or Individual Exchange.

INDIVIDUAL EXCHANGE

Every token you invest in Individual Exchange will earn you a return of one token, and nobody else in the group will gain anything from your investment.

GROUP EXCHANGE

Every token invested in Group Exchange will add TWO tokens to the Group Benefit, and thus add HALF a token to the return for EVERY member of the group, not just the person who invested it.

Example 1: Suppose that everyone in a group invests their token in Individual Exchange. Then each member of the group will get a payoff of 1 token.

Example 2: Suppose that everyone in a group invests their token in Group Exchange. Then there is a total of 4 tokens invested in group exchange, so each member of the group will get a payoff of 2 tokens.

Example 3: Suppose that you invested your token in Individual Exchange, but that the three other members each invested their tokens in Group Exchange. Then your (and the other group members') earnings from the Group Exchange would each be 1.5 tokens (half of 3 tokens), despite the fact you did not invest anything. Because you invested no money in Group Exchange, you gain 1 token from Individual Exchange, so your total earnings would be 2.5, as opposed to 1.5 for other group members.

Example 4: Suppose that you decided to invest your token in Group Exchange, but that the three other members invested their token in Individual Exchange. Then you and everyone else in the group would get a return from Group Exchange of 0.5 tokens. However, the other three members would also get 1 token from Individual Exchange, while you get nothing. So the total earnings for the others would be 1.5, as opposed to 0.5 tokens earned for you.

The table below shows the total Group Benefit, as well as the benefit to each member for each level of Group Investment by the members.

RETURNS FROM THE GROUP EXCHANGE

TOTAL GROUP INVESTMENT BY YOUR GROUP	TOTAL GROUP BENEFIT (AND TO EACH MEMBER)
0	0
1	2 (0.5)
2	4 (1)
3	6 (1.5)
4	8 (2)

As you can see, every token invested in Group Exchange will earn half of a token for EVERY member of the group, not just the person who invested it, and add two tokens to the total Group Benefit. IT DOES NOT MATTER WHO INVESTS TOKENS IN THE GROUP EXCHANGE. EVERYONE WILL GET A RETURN FROM EVERY TOKEN INVESTED— WHETHER THEY INVEST IN THE GROUP EXCHANGE OR NOT.

GROUP

The experiment will last for ten periods. The people in each group will be *varied at random* over the experiment, and therefore will change from period to period.

TOTAL EARNING

Each token is worth 25 cents. YOUR EARNINGS in a given period will be equal to your earnings from the Group exchange, plus your earnings from the Individual exchange. Your total earnings for this task will be equal to the sum of earnings across all 10 periods.

After each period you will be shown the results including the total investment in the group exchange, your payoff from each kind of exchange, and your total payoff.

Please, go through the review question on your computer screen and fill in the blank lines with the values you think are correct.

At the beginning we will run one practice-period experiments to get familiar with the rules. It will NOT count towards your earnings.

ARE THERE ANY QUESTIONS?

Appendix B (Risk measure z-tree screen)

Your ID# **4**					Remaining time [sec]: 42

Description of the task:

Option A returns $2.5 while Option B returns $5 or $0 with some prespecified probabilities listed in the table to the right. Please choose for each 10 situations the option you prefer: either A or B.

Only one situation from all ten will be picked up by computer as a paid task at the end of the experiment. The payoffs in the OPTION B will be determined randomly as in table

Option A
$2.5
$2.5
$2.5
$2.5
$2.5
$2.5
$2.5
$2.5
$2.5
$2.5

Option B
$5 (10%), $0 (90%)
$5 (20%), $0 (80%)
$5 (30%), $0 (70%)
$5 (40%), $0 (60%)
$5 (50%), $0 (50%)
$5 (60%), $0 (40%)
$5 (70%), $0 (30%)
$5 (80%), $0 (20%)
$5 (90%), $0 (10%)
$5 (100%), $0 (0%)

Test Outcome Calculator

If I want test the case in situation:

1 ○ ○ ○ ○ ● ○ ○ ○ ○ ○ 10

Your test choice:

○ Option A
● Option B

[Test!]

Test Outcome

I am testing the :   **situation 5**

If Computer picks the :   **LOW PAYOFF--> $ 0**

Your Choice in that situation was: **You chose B!**

Your payoff would be: 0.0

Situation	OPTION A	OPTION B	YOUR DECISION
1	$2.5	$5 (10%), $0 (90%)	option A ● ○ option B
2	$2.5	$5 (20%), $0 (80%)	option A ● ○ option B
3	$2.5	$5 (30%), $0 (70%)	option A ● ○ option B
4	$2.5	$5 (40%), $0 (60%)	option A ● ○ option B
5	$2.5	$5 (50%), $0 (50%)	option A ○ ● option B
6	$2.5	$5 (60%), $0 (40%)	option A ○ ● option B
7	$2.5	$5 (70%), $0 (30%)	option A ○ ● option B
8	$2.5	$5 (80%), $0 (20%)	option A ○ ● option B
9	$2.5	$5 (90%), $0 (10%)	option A ○ ● option B
10	$2.5	$5 (100%), $0 (0%)	option A ○ ● option B

[OK]

Stochastic game example of z-tree screen

| Your ID# **1** | Period -1 | Practice period | Endowment 1 | Current Earnings 0.0 | Remaining time [sec]: 224 |

Practice 1

Please complete the following exercises

Example 1: Suppose computer randomly selected the return such that 1 token placed in GROUP exchange returns 2.0 tokens. If three other members in the group invested in GROUP exchange, and you invested in GROUP exchange then:

You will get: 8

Each other member gets: 8

Example 2: Suppose computer selects returns in GROUP exchange such that 1 token returns 0.5. If three other members invested in GROUP exchange, and you invested in GROUP exchange as well, then:

You will get: 2

Each other member gets: 2

OK

Help

Please complete two exercises displayed on the sreen above.

| Your ID# **1** | Period 0 | Practice period | Endowment 1 | Current Earnings 0.0 | Remaining time [sec]: 144 |

Practice 2

Please complete the following exercises

Example 1: Suppose computer selects return such that 1 token placed in GROUP exchange returns 2.0 . If three other members in the group invested in INDIVIDUAL exchange, and you invested in GROUP exchange then:

You will get: 2

Each other member gets: 3

Example 2: Suppose computer selects the return in the GROUP exchange such that 1 token returns 0.5. If three other members invested in INDIVIDUAL exchange, and you invested in GROUP exchange, then:

You will get: .5

Each other member gets: 1.5

OK

Help

Please complete two exercises displayed on the sreen above.

| Your ID# **1** | Period 1 | | Endowment 1 | Current Earnings 0.0 | Remaining time [sec]: 24 |

Your Endowment 1

Your decision: your Investment in GROUP Exchange:

Please enter either 1 or 0   1

OK

Help

Please enter your investment in GROUP Exchange.

If you are finished, press with the mouse the "OK" button

| Your ID# **1** | Period 1 | | Endowment 1 | Current Earnings 8.0 | Remaining time [sec]: 37 |

Computer selected the HIGH Return in GROUP Exchange equal to 2.0

Your Investment in GROUP Exchange 1

Total Investment in GROUP Exchange 4

Your Return from INDIVIDUAL Exchange   0.0

Your Return from GROUP Exchange 8.0

Your Return in this period   8.0

Your gross return including return from this period 8.0

Continue

Period	Computer selected Return in GROUP exchange	Your decision to invest 1 token in	Total GROUP investment	Your Payoff from INDIVIDUAL exchange	Your Payoff from GROUP exchange	Your Payoff	Your Total Payoff
-3	2.0	GROUP	4	0.0	8.0	8.0	0
-2	2.0	GROUP	4	0.0	8.0	8.0	0
-1	0.5	GROUP	4	0.0	2.0	2.0	0
0	2.0	GROUP	4	0.0	8.0	8.0	0

Help

Please see the results now.

When you are ready press the "Continue" button.

H -49

| Your ID# 1 | Period 2 | | Endowment 1 | Current Earnings 10.0 | Remaining time [sec]: 35 |

Computer selected the LOW Return in GROUP Exchange equal to 0.5

Your Investment in GROUP Exchange 1

Total Investment in GROUP Exchange 4

Your Return from INDIVIDUAL Exchange   0.0

Your Return from GROUP Exchange 2.0

Your Return in this period   2.0

Your gross return including return from this period   10.0

Continue

Period	Computer selected Return in GROUP exchange	Your decision to invest 1 token in	Total GROUP investment	Your Payoff from INDIVIDUAL exchange	Your Payoff from GROUP exchange	Your Payoff	Your Total Payoff
-3	2.0	GROUP	4	0.0	8.0	8.0	0
-2	2.0	GROUP	4	0.0	8.0	8.0	0
-1	0.5	GROUP	4	0.0	2.0	2.0	0
0	2.0	GROUP	4	0.0	8.0	8.0	0
1	2.0	GROUP	4	0.0	8.0	8.0	8

Help

Please see the results now.

When you are ready press the "Continue" button.

H -50

Post-questionnaire z-tree screen

First Name

Surname

Would you like to participate in further experiments?

○ Yes
○ No

continue

In general, do you think you invested more or less money in the GROUP investment than the people you were matched with?

In deciding upon how much to contribute to GROUP investment, to what extent was did you take into consideration the the benefit to others in your group of four, as opposed the expected benefit to yourself?
- ○ Only considered benefit to self
- ○ Mainly considered benefit to self, but not completely
- ○ Considered both benefit to self and to others about equally
- ○ Mainly considered benefit to others, but not completely
- ○ Only considered benefit to others

On a scale of one to ten (not just for the purposes of this experiment), do you consider yourself a person who is more interested in her/his own self-interest, or someone who is cares more about group? 1) completely self-interested10) completely interested in the public good

On a scale of one to ten (not just for the purposes of this experiment), do you consider yourself a risk-taker, or someone who takes safety-first? 1) complete risk-taker10) completely safety-first

Choosing 1 means you agree completely with the statement 1; Choosing 10 means you agree completely with the statement 10; and if your views fall somewhere in between, you can choose any number in between.1. People should follow the rules of society 10. People should decide for themselves what to do

Choosing 1 means you agree completely with the statement 1; Choosing 10 means you agree completely with the statement 10; and if your views fall somewhere in between, you can choose any number in between. 1. People should sacrifice their own interests for sake of the group 10. People should pursue their own interests as individuals

National questions:

Of which country are you currently a citizen?

In which country do you currently have permanent residence?

In which country were you born?

In which country have you spent the largest portion of your life until now?

National questions:

Of which country are you currently a citizen?

In which country do you currently have permanent residence?

In which country were you born?

In which country have you spent the largest portion of your life until now?

With which country do you identify yourself with the most strongly?

Ethnicity questions:

Within your country, which, if any, religious group do you identify yourself?

Within your country, which, if any, linguistic group do you identify yourself?

Within your country, which, if any, regional group do you identify yourself?

Which of the above, if any, do you identify most strongly?

Please specify if you are
○ Male
○ Female

What is your current academic grade level?
○ Freshman
○ Sophomore
○ Junior
○ Senior
○ Graduate – Masters
○ Graduate – PhD, JD, MD
○ Unclassified

How would you describe the locality where you grew up (if you grew up in multiple localities, please answer according to the mean or typical experience for you).
○ Rural area/Countryside
○ Town (population of less than 100,000)
○ Large City (population of more than 100,000)

Ethnicity questions:

Within your country, which, if any, religious group do you identify yourself?

Within your country, which, if any, linguistic group do you identify yourself?

Within your country, which, if any, regional group do you identify yourself?

Which of the above, if any, do you identify most strongly?

Please specify if you are
○ Male
○ Female

What is your current academic grade level?
○ Freshman
○ Sophomore
○ Junior
○ Senior
○ Graduate – Masters
○ Graduate – PhD, JD, MD
○ Unclassified

How would you describe the locality where you grew up (if you grew up in multiple localities, please answer according to the mean or typical experience for you).
○ Rural area/Countryside
○ Town (population of less than 100,000)
○ Large City (population of more than 100,000)

How long have you been in the USA in years?

How many times have you participated in computer-based experiments before?

How difficult was it to understand the procedures of the experiment?

Do you have any suggestions for improving the experiment?

OK

Manual For CCPV Cross-Country Ethnicity Dataset

Coherence-Based Modeling of Cultural Change and Political Violence Project

http://manoa.hawaii.edu/ccpv/

Dataset is available for download at:

http://hdl.handle.net/1902.1/14465

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&

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Identifying Ethnic Groups

This dataset is unique in social sciences in that it includes data on "latent" cultural groups - i.e. groups that share ascriptive characteristics but may have not as of yet engaged in any observable political action/organization. The ascriptive characteristics we use for group identification are the primary spoken language, religion, geographical-historical origin, and race. Below we outline the algorithm we use to identify groups to be included in the dataset.

Group Identification Algorithm:

1) We identify the languages spoken by at least 3% of national population using Joshua Project (joshuaproject.net), and include also languages that appear in Ethnologue (ethnologue.com) with large enough population numbers.

   Any language that is mentioned in any of the sources that is above a 5% population threshold is automatically included. Languages, whose speakers are more than 3% but less than 5%, is provisionally included with a notation denoting it as a small group (*SmallGrp*=1). The area expert coder makes a final judgment whether to include these based on his/her evaluation of the group's salience.

   Since the distinction between a language and a dialect is in dispute among linguists, we include any language/dialect that is noted by any of these sources with population larger than the cut-off. When dialects are included, we also include in the list of languages the 'mother language' (so in the case of Malaysia, we initially include both Hokkian and Chinese as languages). The 'mother language' is included even if none of the dialects are spoken by

more than 3% of population as long as the population speaking the 'mother language' is big enough.

2) We identify major religions using Joshua Project and World Factbook (with the same 5% and 3% thresholds as used for languages in section 1).

Since the distinction between a religion and a sect is in dispute as well, we include any religion/sect that is noted by the World Factbook (Joshua Project is not used for this since it is biased toward Christianity). If sects are included, we also include in the list of religions the 'mother religion' (so, in the Philippines included are both Catholic and Christian as religions).

If standard practice in the sociology literature, or in the government compiled data, is to combine several separate religions under an 'umbrella-definition', these are combined (for example, 'indigenous religion' is used to denote a group of different indigenous religions in Brazil)

3) Did other sources identify groups that were not yet included? We use either of the following conditions to add groups to the list.

    a. If at least two of Fearon (2003), Alesina et al. (2003), Cederman, Min and Wimmer (2009) and Parker (1997) mention a group, it is included – links to all these sources are posted on our website.

    b. If the government counts that group in its official statistics it is also included.

    c. If the group is economically or politically dominant, even if it is below the 5% threshold, it is also included.

      i. Criteria for economic dominance (either one):

          1. Income per capita, income per household, or wealth per household > 150% of the mean.

          2. Group is considered a market dominant minority by Chua (2003) or MAR. We identify these using the list compiled by Bezemer and Jong-A-Pin (2008).

      ii. Criteria for political dominance: Cederman, Min and Wimmer (2009)

4) In order to identify groups with a common geographical-historical origin or a common racial phenotype that are not identified by a different religion or language, we rely on area experts.

Variables:

Variable	Definition
Groupname	Name of group (most commonly used name). See identification section above for discussion on how groups were identified to be included in dataset.
Smallgrp	Binary variable noting the group's size is between 3-5% of population (smallgrp=1). Groups smaller than 3% are not included in dataset; groups bigger than 5% are considered big.
Pop	Population size of group as % of total population of country. When more than a single estimate of the group's population size is available, we include the largest so that the dataset is as inclusive as possible.
Languagegrp	Group is based on common primary spoken language (binary indicator). See identification section for details.
Religiongrp	Group is based on common religion (binary indicator). See identification section for discussion.
Racegrp	Group is based on common race (binary indicator). See identification section for discussion.
Geogrp	Group is based on common geographical origin (binary indicator). See identification section for discussion.
Othrsrc	Group is based on other sources (binary indicator). See identification section for discussion.
Totpop	Total population of group (calculated either from the *pop* variable with the country's population total taken from the World Development Indicators, or based on primary country-specific sources).
Income	Average household income in local currency (year is noted in the notes file). Area expert may code with 0-4 scale if no income data is found.
data_inc	Source of income data (1-5 scale).
Incomepc	Average per capita income in in local currency (year is noted in the notes file). Data is either directly obtained or calculated from *Income* variable and data

on average household size. Area expert may code with 0-4 scale if no income data is found.

data_incpc   Source of income data (1-5 scale).

Wealth   Average household stock of wealth in local currency (please note year). Data includes estimates of both financial wealth and other assets (land, housing, firms, etc.). Area expert may code with 0-4 scale if no data is found.

data_weal   Source of wealth data (1-5 scale).

Ownership   Percent of country's top enterprises owned by group members. Area expert may code with 0-4 scale if no data is found.

Lab_ind   Percent of group's labor force working in industry/manufacturing relative to national labor force participation rate in industry. 0-4 scale based on available data.

Lab_agr   Percent of group's labor force working in agriculture relative to national labor force participation rate in agriculture. 0-4 scale based on available data.

Lab_serv   Percent of group's labor force working in services relative to national labor force participation rate in services. 0-4 scale based on available data.

Lab_pub   Percent of group's labor force working in public sector relative to national labor force participation rate in public sector. 0-4 scale based on available data.

School   Percent of total adult population of group that has completed at least secondary schooling. 0-4 scale if no data is found.

Literacy   Percent of adult population of group defined as literate – as defined by the country's statistical authority. 0-4 scale if no data is found.

data_lit   Source of literacy and school data (1-5 scale).

Urban   Percent of group's population that resides in urban areas. Area expert may code with 0-4 scale if no data is found.

data_urb   Source of urban population data (1-5 scale).

concentration   Extent to which population is concentrated in homogenous areas (0-1 binary where 1 denotes a geographically concentrated group = a significant majority

of that group lives in a well-defined geographical area).

life_exp   Average life expectancy for group. Area expert may code with 0-4 scale if no data is found.

power_exec   Political power of group by representation in executive branch - Wimmer et al. (ASR, 2009) when groups represented in this dataset.

For Wimmer et al. (2009) data:
0=discriminated
1=powerless, regional autonomy,
2=irrelevant, junior partner, separatist autonomy, state collapse
3=senior partner
4=dominant, monopoly
Area expert may make own judgment or modify the Wimmer designations.

Coding based on the 0-4 scale.

power_militar Political power of group by military strength (0-4 scale).

power_pop   Representation in national entertainment, sports, and media (0-4 scale).

power_elite   Representation in "high" arts (0-4 scale).

MAR_id   Does MAR identify this group? (0-1 binary)

pol-leader   Ethnicity of political leader (0-1 binary; 1 when, for a significant period of time, the country's top leader belongs to ethnic group). Fearon (APSR, 2007).

0-4 Scale	0-5 Scale
0 - No Presence	1 - expert opinion
1 - Below Average	2 - other quantitative measure
2 – Average	3 - other survey
3 - Above Average	4 - calculated from household survey

4 - Dominant Presence	5 - calculated from census

References:

Alesina, Alberto, Arnaud Devleeschauwer, William Easterly, Sergio Kurlat and Romain Wacziarg (2003). Fractionalization. *Journal of Economic Growth* 8(2), 155-194.

Bezemer Dirk and Richard Jong-A-Pin (2008). World on Fire? Democracy,Globalization and Ethnic Violence. MPRA Paper No. 7027.

Chua, Amy (2002). *World on Fire: How Exporting Free Market Democracy Breeds Ethnic Hatred and Global Instability*. Doubleday.

Fearon, James D. (2003). Ethnic and Cultural Diversity by Country. *Journal of Economic Growth* 8(2), 195-222.

Fearon, James, Kimuli Kasara and David Laitin (2007). Ethnic Minority Rule and Civil War Onset. *American Political Science Review* 101(1), 187-193.

Wimmer, Andreas, Lars-Erik Cederman and Brian Min (2009). Ethnic politics and armed conflict: A configurational analysis of a new global dataset. *American Sociological Review* 74(1), 316-337.

Parker, Philip M. (1997). *Ethnic Cultures of the World: A Statistical Reference.* Greenwood Press.

Playing Both Roles: Role Reversal Effects and Culture in Simple Games

Sun-Ki Chai, Dolgorsuren Dorj, Min Sun Kim, Ming Liu, and Katerina Sherstyuk

Summary

Dictator, ultimatum bargaining and trust games have been used ubiquitously in economic experiments to study other-regarding behavior. While altruism, reciprocity and preference for fairness are the most discussed explanations for other-regarding behavior in such games, the origins of such tastes may lie in cultural values. The behavior may be further affected by experimental design choices on whether subjects play a game in both roles, or just in one role. While some studies adopt the role reversal setting and others do not, the effect of this variation in design is still not well understood.

Previous experimental evidence is quite mixed. For example, Charness & Rabin (2002, 2005) compare a one-role study with a two-role study, and find no significant effect of role reversal. Andreoni et al. (2003) report that in a 2-role Ultimatum Game, subjects who show willingness to reject unfair offers as responders are also more generous proposers. Chaudhuri & Gangadharan (2007) report that in their two-role trust game, subjects who returned more also sent more, but not vise versa. However, there are still relatively few experiments that compare one role vs two role treatments within one study.

We consider the significance of cultural values along with the role reversal effects in a unified study using dictator, ultimatum bargaining and trust games. We conducted economic laboratory experiments which consisted in two parts. In part 1, we measured individual cultural values using a survey instrument based on World Values Survey (WVS). In part 2, we correlate cultural values with behavior in experimental games. Two main treatments included experimental subjects playing either just one role (e.g., only the dictator in the dictator game), or both roles (e.g., both dictator and the recipient in the dictator game.)

We find that aggregate behavior was somewhat different across the one-role and two-role treatments, but not in all roles and all games. Importantly, we find that cultural variables had a more pronounced effect on behavior in the two-role treatment.

Experimental design -- details

1. Part 1: Survey instruments. We measured cultural values (Altruism and Reciprocity) through attitudinal questions drawn from the World Values Survey. 11 questions were used to measure Reciprocity scores, and 11 questions to measure Altruism scores

2. Part 2: Experimental games used. Experimental subjects participated in Dictator (DG), Ultimatum Bargaining (UB), and Trust games (TG).

- Dictator Game (DG): Sender chooses the split of $10, Receiver accepts

- Non-convex UB: Proposer chooses the split of $10, Responder accepts or rejects

- Convex UB: Proposer chooses the percentage split, Responder chooses the amount of money to divide (between $0 and $10 conditional on the split)

- Non-convex TG: Sender chooses to send or not $6, Receiver chooses how much of the sent amount (which is doubled) to return

- Convex TB: Sender chooses how much of $6 to send, Receiver chooses how much of the sent amount (which is doubled) to return

3. **Design: details and procedures.**

- Both 1-role and 2-role (role-reversal) treatments

- Stranger design: each participant is re-matched with a different person for every decision

- Strategy method used in all games

- No feedback between decisions

- Two decisions are randomly chosen as paid decisions at the end

- Computerized sessions, implemented in z-tree

- 120 subjects in 9 sessions in the one-role design (60 subjects in each role), 100 subjects in 6 sessions in the two-role design, all at the University of Hawaii

4. **Experimental Results:**

Games: We find that, overall, the statistics for each game are comparable with other studies. There are some differences between 1-role and 2-role treatments. In Dictator games, 1-role mean amount sent of 3.93 is marginally higher than 2-role mean of 3.32. However, in non-convex and convex ult. bargaining games, the offer behavior is largely the same: the 1-role mean offer of 4.65 is no different than the 2-role mean offer of 4.48. For the responder behavior, the minimal amounts that the responders are willing to accept is as follows: the 1-role mean of 2.5 is no different than 2-role mean of 2.3. Yet, in the 1-role treatment: 40% of responders accept $1 or less; while in 2-role: 50% accept $1 or less. In the convex ult. bargaining games, we find that a higher percentage of responders were enforcing the 50/50 split norm in the 1-role than in 2-role treatment.

Survey results: Correlations between cultural attitudes and behavior in games. We classified all subjects into 3 cultural types:

LH – Low Reciprocity (social Norms), High Altruism

LL -- Low Reciprocity and Altruism (Selfish)

H – High Reciprocity

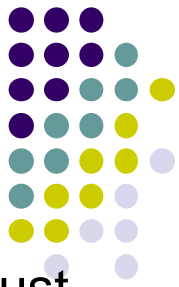Given the classification, we find that there were slightly fewer altruists and more selfish in 1-role vs 2-role. In one-role treatment,   24 % were LH, 31.7 % were LL (selfish), and 44% were H (HH-20, HL-24). In two-role treatment: 31 % were LH, 21 % were LL, 48% were H (HH-23, HL-25).

Effects of cultural variables on behavior:

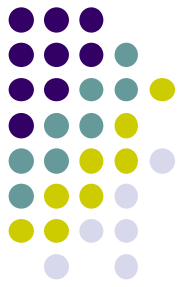One-role treatment:

- LH (altruists) offer more percentage in dictator games (p<0.05), trust more (p<0.05), send back more if trusted in binary game (p<0.01).

- H (reciprocal) trust less in binary trust games (p<0.1).

- LL (selfish) offer less than altruists in dictator game (p<0.05).

Two-role treatment:

- LH (altruists) offer more in ultimatum games (p<0.05), accept lower offers (p<0.05), trust more in the binary trust game (p<0.1 level).

- H (reciprocal) require higher offers to accept (p<0.05) in UG, trust in both trust games (p<0.1).

- LL (selfish) divide more dollars than H (reciprocal) in the convex UG game, as punishing the proposer is costly (p<0.05).

5. **Conclusions:**

In sum, we find some differences in behavior between 1-role and 2-role treatments, irrespective of cultural attributes

   a. DG: more giving over 50% in 1-role than 2-role

   b. UG: Fewer responders are willing to accept $1 or lower in 1-role than 2-role

   c. Convex UG: More responders focus on the 50/50 social norm division in 1-role

   d. Trust Game: Fewer people trust in 1-role

Further, we find that cultural attributes are more pronounced in 2-role treatment.

Playing Both Roles: Role Reversal Effects and Culture in Simple Games
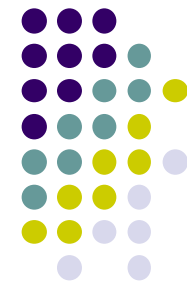
Sun-Ki Chai, Dolgosuren Dorj, Min Sun Kim, Ming Liu, and Katerina Sherstyuk

University of Hawaii at Manoa

ESA – November 14 2009

Motivation and Objectives

Broad objective: use economic experiments to study other-regarding behavior, with a specific focus on cultural differences

Focus on simple economically relevant games:

- dictator, ultimatum bargaining, and trust games

Narrow objectives of this paper:

- study the role reversal effect on people's behavior in these games

- see whether cultural characteristics may help explain behavioral differences

Other studied of role reversal (one-role vs two-role)
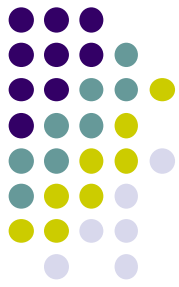
The evidence is generally mixed

- Charness & Rabin, 2002, 2005: Dictator, response games: no significant effect

- Andreoni et al. 2003: Ultimatum Game, 2-role: subjects who show willingness to reject unfair offers as responders are also more generous proposers

- Chaudhuri & Gangadharan, 2007: Trust game: those who returned more sent more but not vise versa

Still relatively few experiments that compare one role vs two role treatments within one study

This study

- **Research question:**
  - How does role reversal affect subject's social behavior?
- **Experimental Design:**
  - Part 1: measure individual cultural values using a survey instrument
  - Part 2: correlate them with behavior in experimental games
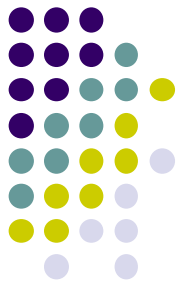
    Treatments: One-role and two-role (role-reversal)
- **Findings (very preliminary):**
  - Aggregate behavior is somewhat different across treatments, but not in all roles and all games
  - Cultural variables were more pronounced in the two-role treatment
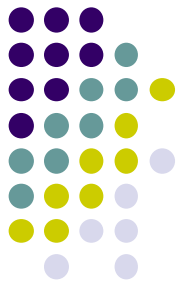
1. Design: Survey instrument

- We measure cultural values (Altruism and Reciprocity) through attitudinal questions drawn from the World Values Survey

- 11 questions to measure Reciprocity scores, 11 questions to measure Altruism scores

2. Design: Games

- Dictator (DG), Ultimatum Bargaining (UB), and
Trust games (TG)

Dictator Game (DG): Sender chooses the split of $10, Receiver accepts

Non-convex UB: Proposer chooses the split of $10, Responder accepts or rejects

Convex UB: Proposer chooses the percentage split, Responder chooses the amount of money to divide (between $0 and $10 conditional on the split)

Non-convex TG: Sender chooses to send or not $6, Receiver chooses how much of the sent amount (which is doubled) to return

Convex TB: Sender chooses how much of $6 to send, Receiver chooses how much of the sent amount (which is doubled) to return

3. Design: details and procedures

- Both 1-role and 2-role (role-reversal) treatments
- Stranger design: each participant is re-matched with a different person for every decision
- Strategy method used in all games
- No feedback between decisions
- Two decisions are randomly chosen as paid decisions at the end

- Computerized sessions, implemented in z-tree

- 120 subjects in 9 sessions in the one-role design (60 subjects in each role), 100 subjects in 6 sessions in the two-role design, all at the University of Hawaii

Experimental Games Results

- Overall statistics by each game: standard results
- Differences b/w 1-role and 2-role: some

	1-role mean	st.dev.	2-roles mean	st.dev.	p-value 1-role vs. 2-roles two-sided	one-sided
Dictator game:						
offer, $	**3.93**	3.04	**3.32**	2.22	**0.1443**	**0.0722**
Ultimatum bargaining						
offer, $	**4.65**	2.33	**4.48**	2.12	**0.6371**	**0.3186**
min acceptable, $	**2.50**	1.70	**2.30**	2.07	**0.5292**	**0.2646**
Trust, non-convex						
% of subjects who trust	**33%**		**41%**		**0.1120**	**0.0560**
$ returned, out of $12	**4.52**		**4.43**		**0.8451**	**0.4225**

One-role vs. two-role Dictator game
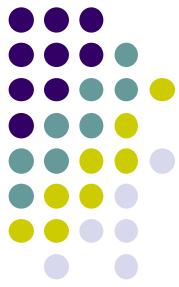
Figure 1. Offers in dictator game, one-role treatment, N=60
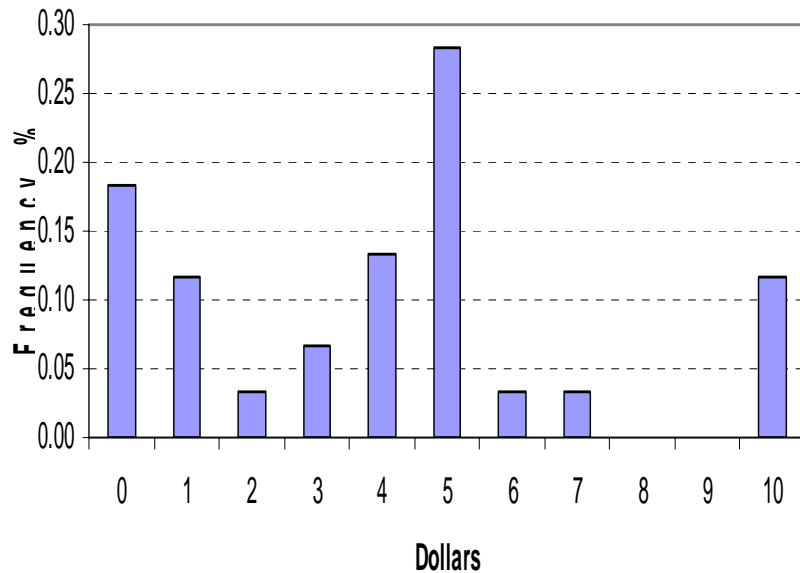
Figure 2. Offers in dictator game, two-role treatment, N=100
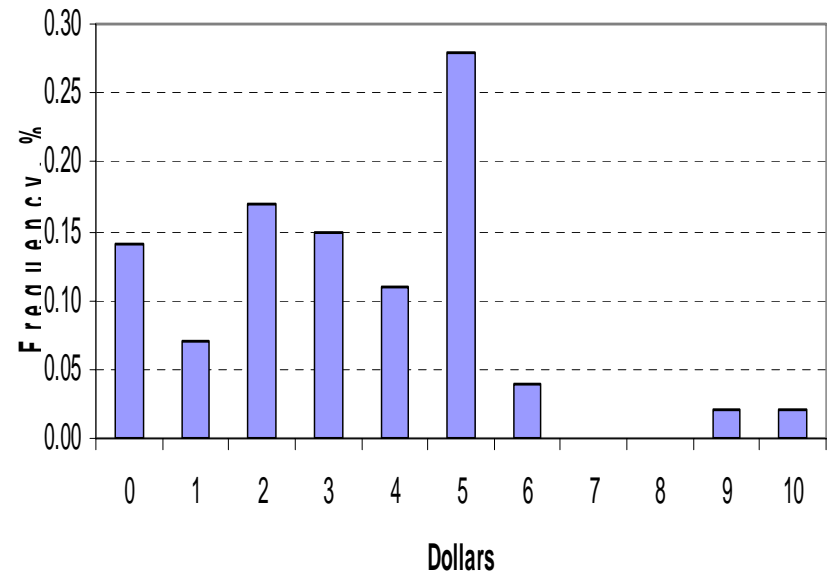
1-role mean amount sent of 3.93 is marginally higher than 2-role mean of 3.32

Offers in non-convex and convex ult. bargaining games: Same

Figure 9. Offers in standard vs. convex ultimatum games, one-role treatment
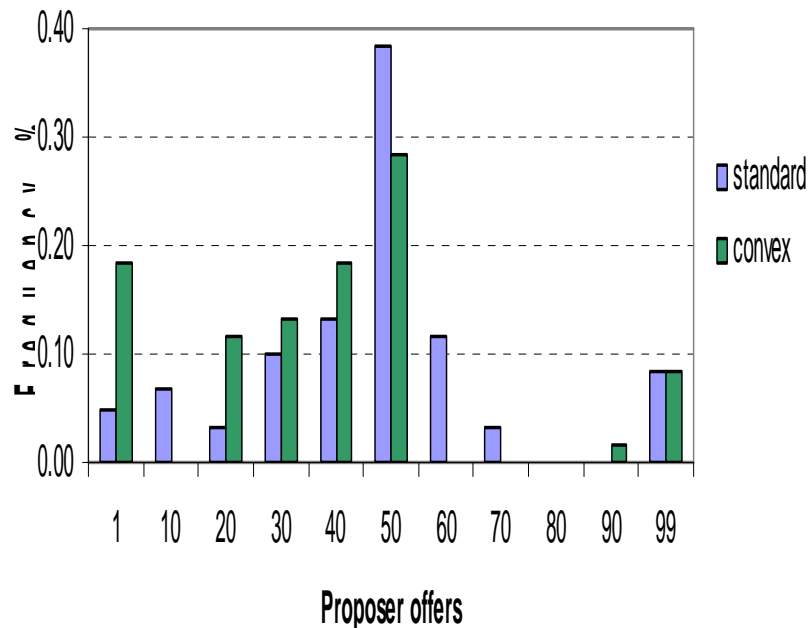
Figure 10. Offers in standard vs. convex ultimatum games, two-role treatment
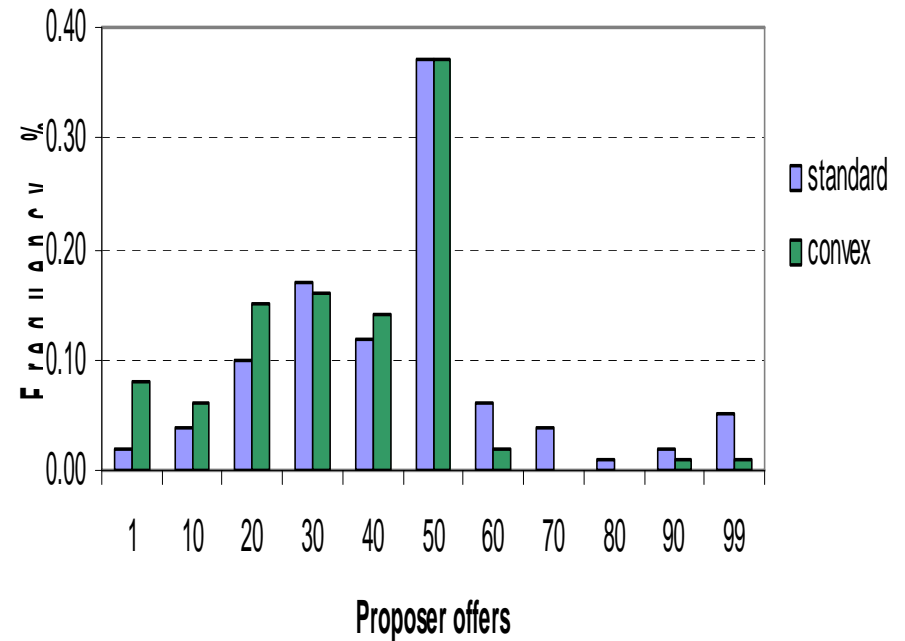
1-role mean offer of 4.65 is no different than 2-role mean offer of 4.48

Ult. Bargaining (non-convex), responder: min acceptable amounts
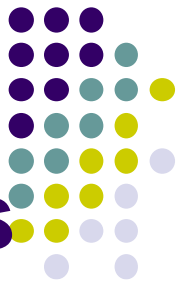
Figure 5. Min acceptable amount in UG, 1-role
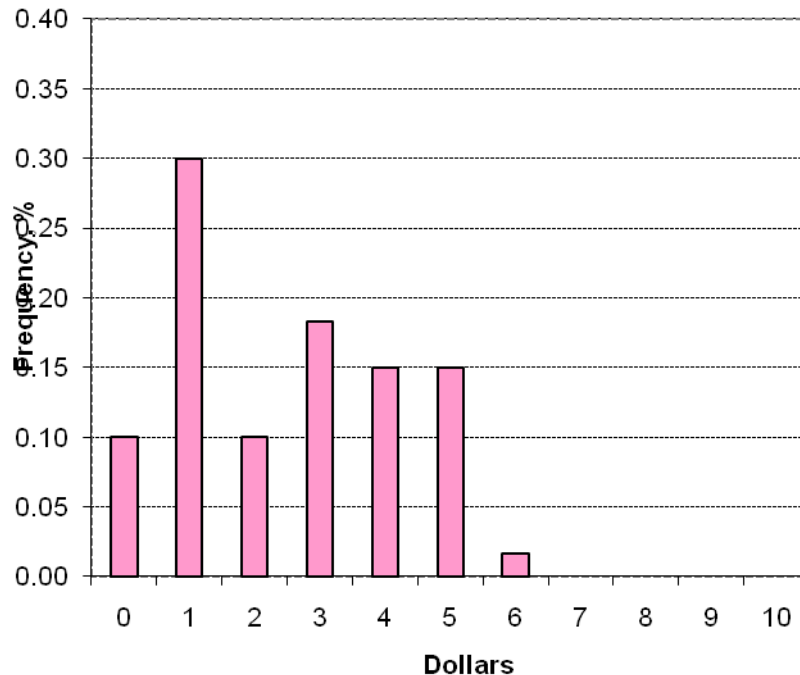
Figure 6. Min acceptable amount in UG, 2-role
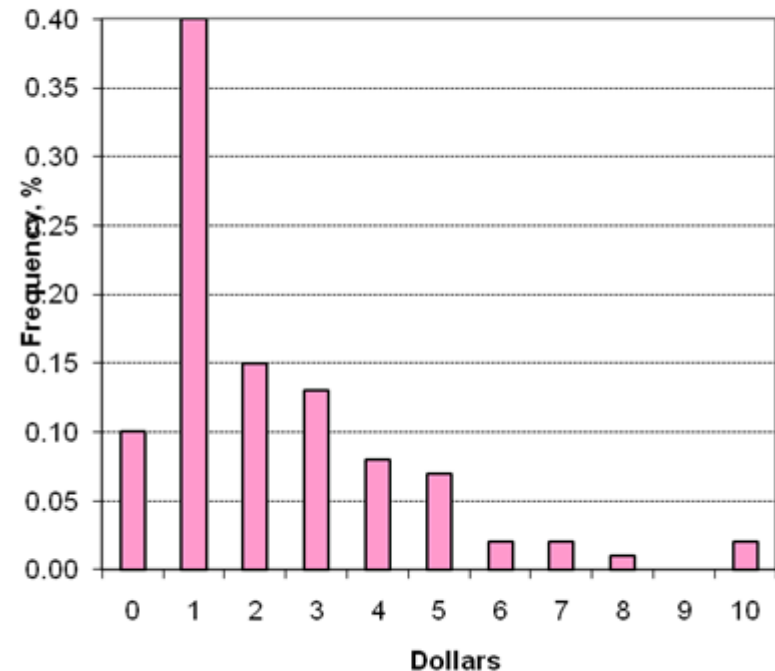
1-role mean of 2.5 is no different than 2-role mean of 2.3
1-role: 40% accept $1 or less; 2-role: 50% accept $1 or less
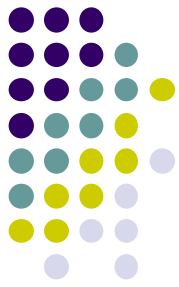
Responder behavior in convex UG: pie size ($1-10) as a function of % offered

Type	1-role, # subjects	1-role, %	2-role, # subjects	2-role, %
~Increasing	35	58%	59	59%
Max at 50/50	9	15%	8	8%
Flat max $10	13	22%	14	14%
Other	3	5%	19	19%
Total	60	100%	100	100%

Increasing: reciprocal; Max at 50/50: social norm;
Flat max $10: "classic" rationality

UG, convex: Increasing responses
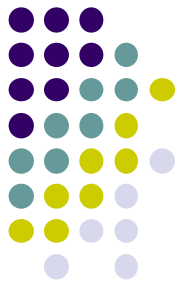
1-role, Increasing Type (58%)
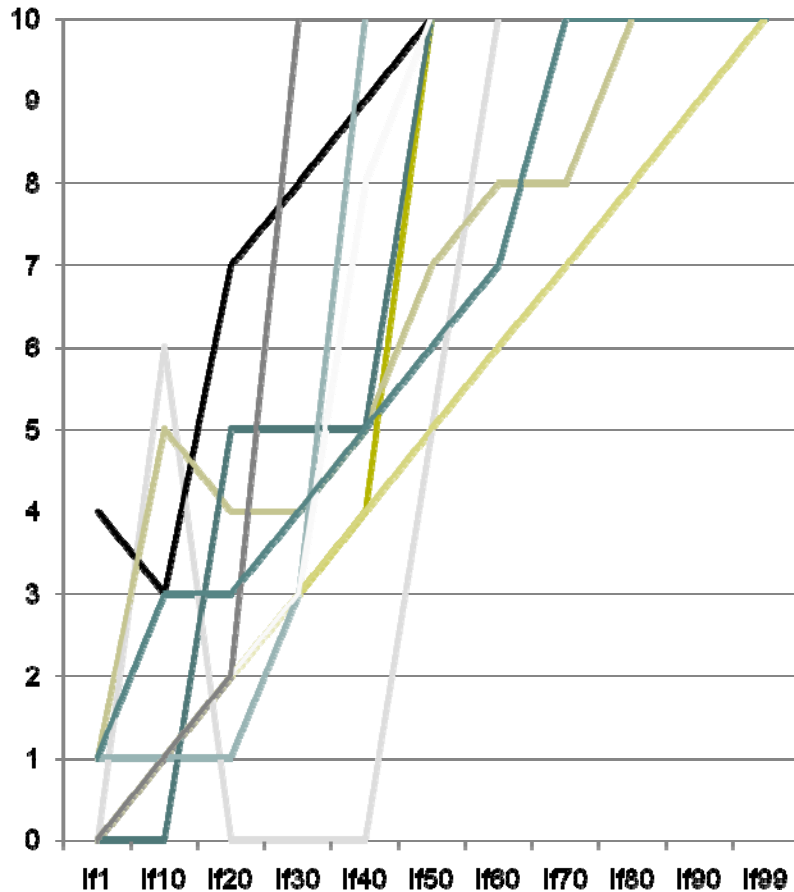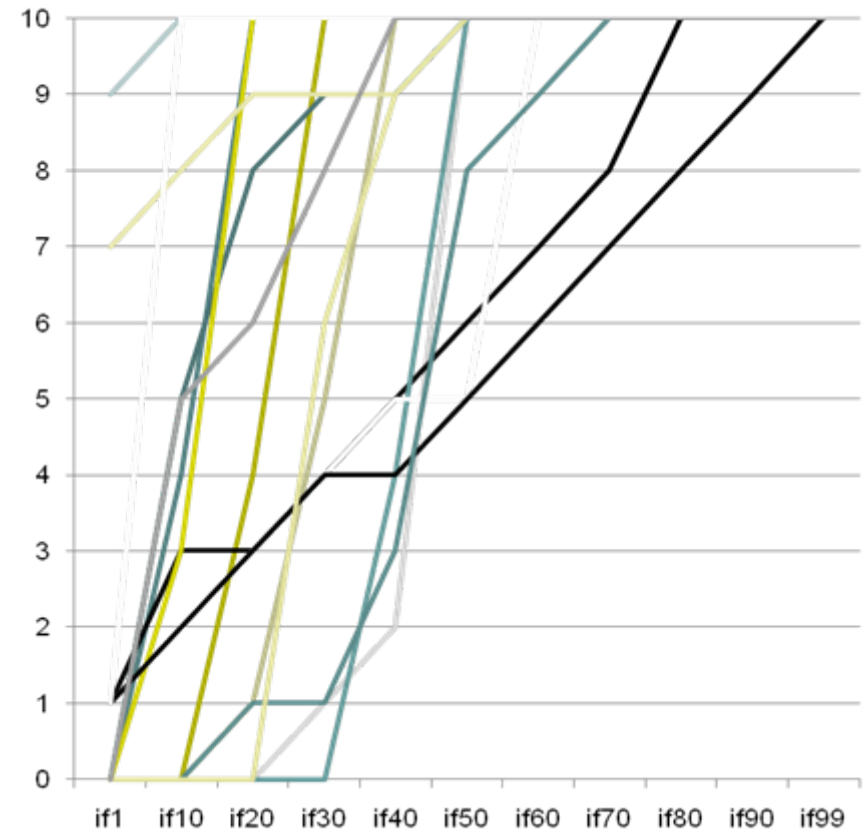
Same % of increasing responses

2-role: Increasing type(59%)

UG, convex: Max at 50/50

2-role, Max at 50/50 (8%)

1-role, Max at 50/50 (15%)
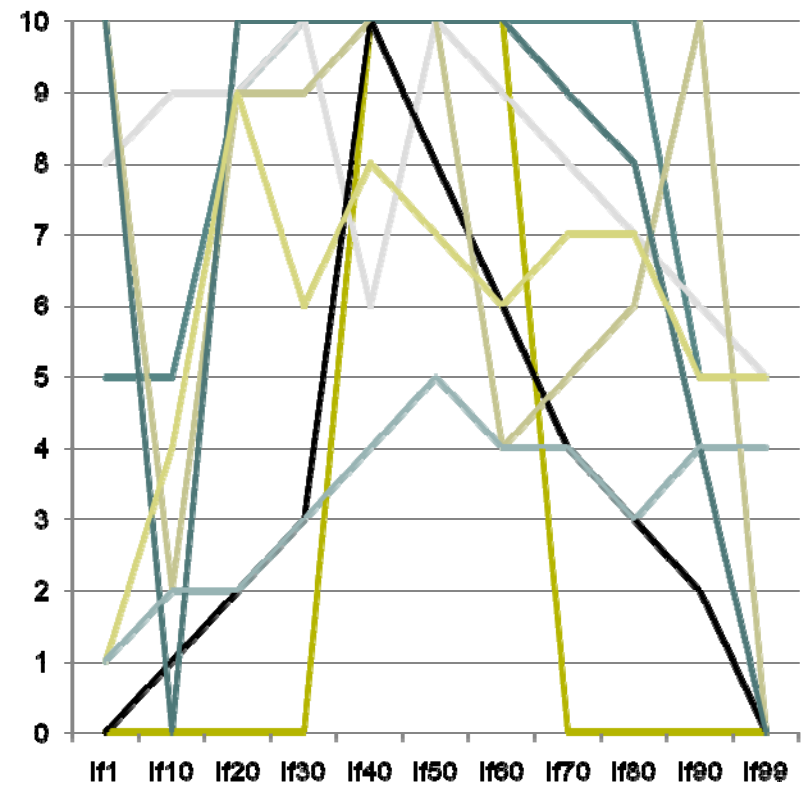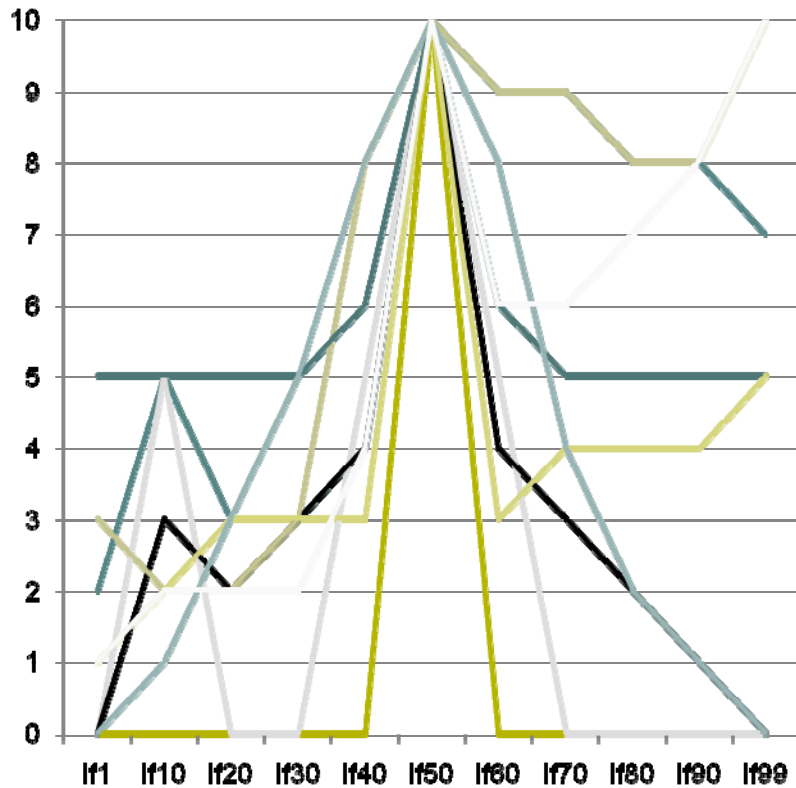
Higher % of responders enforcing the 50/50 split norm in the 1-role
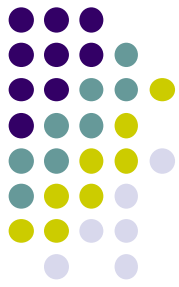
Experimental Results:
2. Survey results
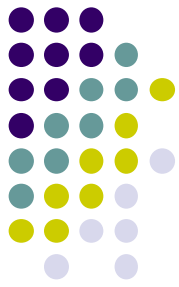
Correlations b/w cultural attitudes and behavior in games

Survey Results

Classification of cultural types:

LH – Low Reciprocity (social Norms), High Altruism

LL -- Low Reciprocity and Altruism (Selfish)

H – High Reciprocity

Distribution of types:

In one-role treatment: 24 % were LH

31.7 % were LL (selfish)

44% were H (HH-20, HL-24)

In two-role treatment: 31 % were LH

21 % were LL

48% were H (HH-23, HL-25)

Slightly fewer altruists and more selfish in 1-role vs 2-role

Effects of cultural variables on behavior

One-role treatment:

- LH (altruists) offer more percentage in dictator games ($p<0.05$), trust more ($p<0.05$), send back more if trusted in binary game ($p<0.01$).

- H (reciprocal) trust less in binary trust games ($p<0.1$).

- LL (selfish) offer less than altruists in dictator game ($p<0.05$).

Two-role treatment:

- LH (altruists) offer more in ultimatum games ($p<0.05$), accept lower offers ($p<0.05$), trust more in the binary trust game ($p<0.1$ level).

- H (reciprocal) require higher offers to accept ($p<0.05$) in UG, trust in both trust games ($p<0.1$).

- LL (selfish) divide more dollars than H (reciprocal) in the convex UG game, as punishing the proposer is costly ($p<0.05$).

Summary (preliminary)

- **Some differences in behavior between 1-role and 2-role treatments, irrespective of cultural attributes**

  - DG: more giving over 50% in 1-role than 2-role (?)

  - UG: Fewer responders are willing to accept $1 or lower in 1-role than 2-role

  - Convex UG: More responders focus on the 50/50 social norm division in 1-role

  - Trust Game: Fewer people trust in 1-role

- **Cultural attributes are more pronounced in 2-role**
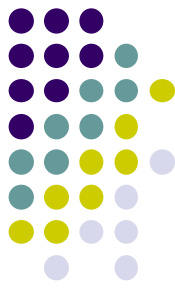
Difference between cultural types (**one-role treatment**)

mean/ st.dev.	LH High- groupness	LL individualist	HH, HL high- gridness	p-value	p-value	p-value
				Ho:	LH=	LL=
Grid	0.27	0.27	0.57			
Group	0.6	0.4	0.51	LH=LL	High-grid	High-grid
Dictator game:						
Offer, $	**5.53**	**3.05**	**3.74**	**0.0304**	**0.0574**	**0.7177**
	2.8	**3.03**	**2.91**	**>**	**>**	
Trust game:						
Avg. send, $	**4.29**	**2.67**	**2.35**	**0.1053**	**0.0292**	**0.5979**
	2.81	**3.07**	**2.99**		**>**	
Conv.Trust, $	**3.21**	**2.44**	**2.22**	**0.2983**	**0.0957**	**0.4134**
	2.61	**2.87**	**2.09**		**>**	

Difference between cultural types (**two-role treatment**)					
	LH	LL	HH, HL	p-value	p-value	p-value
mean/	High-	individualist	high-	Wilcoxon ranks sum test		
st.dev.	groupness		gridness			
Grid	0.26	0.32	0.55	Ho:	LH=	LL=
Group	0.6	0.4	0.49	LH=LL	High-grid	High-grid
Ultimatum bargaining:						
Offer, $	**5.1**	**4.24**	**4.19**	**0.0375**	**0.0526**	**0.7658**
	2.04	**2.1**	**2.14**	**>**	**>**	
Div. Rule, %	**37.8**	**32.5**	**35.7**	**0.0664**	**0.5302**	**0.2038**
	17.1	**21**	**18.4**	**>**		
Designate, $	**8.13**	**8.67**	**6.88**	**0.3090**	**0.1722**	**0.0114**
	3.26	**2.99**	**3.4**			**>**
Trust game:						
Avg. send, $	**3.93**	**2.53**	**3.75**	**0.0918**	**0.7082**	**0.0983**
	2.9	**3.04**	**2.94**	**>**		**<**
Convex Trust, $	**2.83**	**2.32**	**3.13**	**0.2681**	**0.6445**	**0.0666**
	2.42	**2.4**	**2.21**			**<**

Does Religion and Ethnic Identity influence Social Preferences? Evidence from Field Experiments in the Philippines

Sun-Ki Chai, Debbie Gundaya and Ekaterina Sherstyuk

Abstract

We conducted field experiments in the Philippines to examine (1) whether Muslims and Christians differ in their economic behavior such as risk attitudes, time discounting and contribution to public goods; and (2) whether there are patterns of in-group favoritism and out-group discrimination among the two religions and various ethno-linguistic groups in the Philippines. Our experiments were carried in three areas in Metro Manila with established Muslim settlements. Our results show that overall, there is no significant difference between our Muslim and Christian participants in terms of risk attitudes and time preference. Our Muslim participants, particularly those from the lowest income community among our locations, tend to send higher contributions to the public funds than their Christian counterparts. Generally, our data showed no sign of religious or ethnic in-group favoritism as evidenced by the amounts sent to a stranger in our four variants of the dictator game. However, when disaggregated by location, our data shows slight in-group favoritism among the lowest income and highly segregated Muslim community (Culiat). It appears that there is no strong evidence of in-group favoritism and out-group discrimination that follows religious or ethnic divide. The level of assimilation and degree of a community's segregation may have an impact on the in-group/out-group bias. One important caveat is that our experiments were conducted in relatively peaceful Muslim communities in Manila and not in the conflict zones of Moro Mindanao. Our results, however, bodes well for possible policies for negotiating peace among the conflicting regions in the South. Migrant Muslims in Metro Manila behave similar to their Christian counterparts and there is no

strong evidence of in-group/out-group biases. Thus, modes of assimilation such as communication and contact among groups may have positive effect on peace negotiations.

Introduction

While various dimensions of a person's identity and how they affect behavior have long been explored in psychology and sociology, similar analyses in the field of economics is a fairly recent development (Akerlof, 2000; Solow and Kirkwood, 2002; Chen and Li, 2006; Benjamin, et.al., 2007, Li et.al, 2008,). Since the seminal work of Henrich et al (2001), it has become evident that multidisciplinary research that brings the tools of experimental economics to the field unveils evidence that relates behavior in experimental play to patterns of everyday life, economic organization and political structure. Results from the field thus expand the utility of experimental economics to the examination of important social concerns such as provision of public goods (Habyarimana et al, 2007) and ethnic conflict (Bahry and Wilson, 2004). This paper aims to contribute to this growing body of knowledge by using field experiments to explore the links between social identity and game behavior among a population characterized by religious and ethnic conflict.

We conducted our field experiments in three areas with established Muslim settlements in Metro Manila, Philippines. We seek to contribute to social theory in three fronts: (1) the growing theory of social identity formation by testing three of its variants: ascriptive identity theory, modernization theory and pan-ethnolinguistic identity theory; (2) the theory of ethnic conflict by examining how patterns of in-group and out-group preference in the experimental data reflect lines of existing ethnic conflict; and (3) the social preference literature by examining how politically salient markers of social identity relates to economic behavior.

The field experiments were in September-October 2009 with a total of 305 participants. Our experimental design features a sample from two religions, Islam and Christian, and the major ethno-linguistic groups in the country. Religion was chosen are as primary dimension of interest because of its socio-political significance in the context of the Philippine society. There has been a long-standing history of conflict arising from a Islamic groups' demand for autonomy[1]. However, factions within Muslim ethnic groups complicate their politics and had resulted to violent conflicts. Thus, we hypothesize that religious affiliation is a salient feature of Filipino identity and may have important impact on one's behavior towards others. Prior studies have found that assigned group identities have significant effects on social preferences (Chen and Li, 2006). We aim extend this line of inquiry by exploring differences between groups that have salient political divisions.

Exploring the roots of the conflict is understandably complicated. What this paper will attempt to untangle through controlled experiments is the link between the Muslim/Moro identity and social preferences. The paper's innovation is to look at the identity on two dimensions—religion and ethnicity—and though various measures characterize how the said social markers impact economic decisions. The Philippines is ideal for this type of study for the Muslims in the country are at once a distinct religious group that stands out as a minority in a mostly Christian country and is divided within by various ethnic sub-groups. Since conflict in Moro Mindanao follows the lines of ethnic divide, measuring social preferences such as in-group/out-group bias, cooperation and trust between groups will have implications on the ways to design policies for negotiating peace among the conflicting Moro factions.

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[1] See Appendix A for a detailed discussion of the historical and political evolution of the Moro ethnic identity in the Philippines and the Moro movement for regional autonomy.

Research Questions and Hypothesis

Our specific research questions are:

1. Do Muslims and Christians differ in their risk attitudes, time preference and contribution to public goods?

2. Do people discriminate between religious and ethnic in-group and out-group members?

3. Is in-group ethnic discrimination more pronounced within the Muslim community than the Christian community?

4. What individual characteristics are important in predicting economic decision making?

Resolving the last question is the essential task of this paper which involves testing three competing theories of ethnic identification:

A) **Ascriptive characteristics theory.** [References?]. This theory predicts that ethnic identification dominates religious identification. Hence, its null hypothesis is that economic decisions are influenced by one's ethnic identity than religious identity.

B) **Modernization theory** (Newman, 1991). This theory predicts that variations in economic decisions are mostly explained by socio-economic characteristics. It hypothesizes that individualistic behavior and an absence of religious or ethnic discrimination among people of higher SES.

C) **Panethnolinguistics theory** (Chai, 2005). This theory predicts that ethnic boundaries are not rigid but change in response to social environment. Hence, the Muslim migrants becomes less attached to their ethnic in-group the longer they have been living in Metro Manila. This would explain a pattern of in-group/out-group bias that

is associated with length of stay in Metro Manila, favors the religious in-group and shows no inter-ethnic bias.

Literature Review

The notion that an individual's behavior is affected by one's sense of self and sense of belonging to a group has long been explored in other fields of the social sciences, but has only been explored recently by economists. Akerlof and Kranton's (2000) influential paper was the first to propose a model that incorporates identity, a function of established social categories, in the utility function. They show that identity changes outcomes through its impact on one's own payoffs and its externality-driven effect on others' payoffs. They further demonstrate how the choice of identity can affect individual's economic behavior and how changes in established social categories and behavioral prescriptions can influence identity-based preferences.

Benabou and Tirole (2007) took this line of thought further by endogenizing identity in the utility function. According to this model, one's sense of identity evolves through the management of beliefs and cognitive mechanisms. Drawing from findings in social psychology, Wichard (2007) pointed out that identity depends on one's membership to numerous social in-groups. Hence, identity has multiple aspects and the one that prevails would depend on the social context. The study defined social identity as a function of in-group homogeneity, group size, and the presence of outer reference groups. One's decisions then depend on the social context and the strength of one's association with the social groups concerned.

Davis (2006) suggest modeling identity as a production function to reflect the idea that people put effort in constructing or maintaining identity. Aguiar et al (2008) propose a model that distinguished personal identity from social identity.

In sum, economic theory has progressed from the absence of identity in the utility function to acknowledging that identity affects actions and can have several dimensions. Hence,

economic theory with endogenous identity provides a context for analyzing multiple dimensions of identity. Our paper aims to contribute to this growing field by testing patterns of social identity formation.

Alongside the advances on the theory front, a progression of experimental studies has unveiled links between identity and social preference. We will focus our review on studies that analyzed patterns of ingroup/outgroup preference, including those that explored the impact of conflict in social preference.

Numerous studies in the laboratory and field have found patterns of ingroup prefence and outgroup bias. Even with minimal group, Chen and Li (2006) find that participants in the laboratory are more altruistic towards ingroup partners than they are with outgroup partners. The minimal group in this study was artificially constructed by eliciting participants' preference between two types of painting. The participants were grouped according to their preferred painting. One would expect that this pattern of social preference would be even more pronounced if the group identity is based on real-life groups. Indeed, in Lorenz et al (2006), evidence from an experiment with Swiss military officer candidates shows that cooperation is higher with in-group members and punishment is stronger when defection affects ingroup members as opposed to outgroup members.

Tanaka and Camerer (2008) find an unusual pattern of social preference among three ethnic groups in Vietnam. They find that the high-status groups of Vietnamese and Chinese shows outgroup favoritism towards the low-status group of Kmer when games that measure altruism. However, in trust games involving risky investment, the high status groups exhibit the typical pattern of out-group bias against the Kmer. They interpreted these results as evidence

that high status groups may show altruism or patronage towards the low status-out group, but refrain from trusting them in risky business exchange.

Field experiments examining intergroup conflict show that contrary to what one would expect, pro-social tendencies remain in societies that experienced armed conflict. Nonetheless, there is some evidence of ethnic ingroup preference and outgroup discrimination. In a field experiment in transitional Russian Republics, Bahry and Wilson (2005) find that people still trust strangers, and that ethnicity does not affect the decision to trust. In the same vein, Whitt and Wilson (2006) find considerable evidence of fairness across all ethnicities in Bosnia. This field experiments also shows patterns of positive ingroup bias and negative outgroup discrimination among ethnic groups. Furthermore, individuals who indicated strong commitment to their ingroup identity are least likely to be fair to the outgroup.

What motivates this pattern of behavior? A few experiments have looked at various mechanism that may provide explanation to the observed patterns of social preference. McLeish and Oxoby (2007) find that when identity is motivated by inter-group threat, there is stronger cooperation towards the ingroup. Charness et al (2006) find that the presence of an audience and feedback motivates participants towards cooperation. Habyarimana et al (2007) find evidence that a technology mechanism—in the form of the social network linkage among co-ethnics— may explain the higher level of cooperation among co-ethnics than non-co-ethnics.

Thus far, the evidence from the lab and the field shows that ingroup preference and out-group bias prevails, and is affected by institutions and mechanisms that define the network of relationships within groups. In our study, we focus on two dimensions of group identity: religion and ethnicity. We aim to contribute to the literature by examining how patterns of

social preference in the experimental data reflect lines of existing ethnic conflict and by examining how politically salient markers of social identity relates to economic behavior.

Research Design

We designed our research to enable us to examine how identity, in the form of religion and ethnicity, affect economic decisions, particularly among a population that has experienced inter-group conflict.

I. Sites

We selected the Philippines as the site of our field experiment for its ethnic diversity and the presence of political conflict that has religious and ethnic underpinnings. The country is 95% Catholic but has a long history of conflict in the Southern Mindanao, the region where a majority of its Muslim population resides. The conflict in the South is rooted in Muslim political groups' claim for autonomy.[2] Since the 1970s, Southern Mindanao has suffered from intermittent clashes between the national government and the Muslim groups, which were at times eased by peace agreements and cease fires. It would have been ideal to conduct our experiments in Muslim Mindanao, but it was unsafe to do so due to the risk posed by the uncertain political

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[2] The unrest originated when the Moro National Liberation Front (MNLF), a Muslim political group formed in the early 1970s, revolted against the government, seeking to form an independent nation. The ensuing clash between the MNLF and the government's army resulted to severe casualties. Since then, there have occurred splits in the ranks of the Moro leaders over the degree of cooperation with the national government. Two other separatist groups emerged (Moro Islamic Liberation Front and Abu Sayyaf).

climate in the Mindanao region. We instead identified three sites in the country's capital that has established Muslim settlements: Maharlika Village in Taguig City, Barangay Culiat in Quezon City, and Greenhills in San Juan City. The first two locations are low-income communities [insert income statistics] while the third is a commercial area (shopping mall) where a pronounced number of Muslim merchants own small retail businesses. The Muslim communities in Metro Manila are composed of immigrants from the South who tend to live in closely-knit communities like the sites we selected.

II. Sample Selection and Recruitment

The field research team throughout all sites was composed of two researchers and two to four recruiters who also helped as research assistants during the experiments. For each site, we used the map of the area to randomize recruitment by household. We divided the area street maps by recruitment zones, and selected nodes to serve as starting points for each recruitment team. Starting from each node, teams recruited from every third or fifth house depending on the density of the sample areas. Two teams of two research assistants each set out every morning to recruit participants for the sessions, which were generally held in the afternoon[3]. The recruiters were all trained to follow a recruitment script. We limited our sample to include only one participant per household. Once a participant agrees to take part in the experiment, he/she receives a confirmation card with information on the time and location of the experiment. One of the researchers then asks the participant some basic demographics questions (See Appendix __ for the Pre-Survey questions).

III. Experiment Sessions

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[3] One session was held in the morning; the participants for this experiment were recruited the day before.

The experiment sessions were held in the most accessible and convenient locations we could find for each site. At the first site, we used a classroom for all sessions. The second site posed challenge for finding one location so we used a Muslim community room within a prayer area for one session, a restaurant for another and a community recreation center for the rest of the sessions. We used a restaurant for all sessions in the third site. For all locations, we made arrangement so that we can keep non-participants from entering the area during the experiments to minimize distractions. For each site, we held pure Muslim sessions, mixed Muslim and Christian sessions, and pure Christian sessions. We had 328 participants from 17 sessions. The type of session, site and number of participants are summarized in Table 1.

Table 1.

Session	Location	Type	Ramadan	Number of participants
1	Taguig	Pure Muslim	Yes	22
2	Taguig	Pure Muslim	Yes	26
3	Taguig	Mixed (Muslim and Christian)	Yes	24
4	Taguig	Mixed (Muslim and Christian)	Yes	20
5	Taguig	Pure Christian	Yes	20
6	Culiat	Pure Muslim	Yes	15
7	Culiat	Pure Muslim	Yes	20
8	Culiat	Mixed (Muslim and Christian)	Yes	25
9	Culiat	Mixed (Muslim and Christian)	Yes	24
10	Culiat	Pure Christian	No	20
11	Greenhills	Pure Muslim	No	17
12	Greenhills	Pure Muslim	No	15
13	Greenhills	Mixed (Muslim and Christian)	No	20
14	Greenhills	Mixed (Muslim and Christian)	No	22
15	Greenhills	Pure Muslim	No	8
16	Greenhills	Pure Christian	No	18
17	Taguig	Pure Muslim	No	12
			TOTAL	**328**

a. Sign-in

Upon arrival, a research assistant verifies the identity of the participant by checking the person's name and confirmation card against the recruitment rooster. The participant is asked to self-identify her/her religion and ethnicity, and is then asked to select from two stacks of experiment booklets. Allowing them to choose one booklet out of two stacks was a mechanism to randomly assign roles A and B (for the trust game, discussed further below). The participants were not told at this point what type they have selected. Once a participant has chosen a booklet, another research assistant checks the sign-in sheet to verify the participant's ethnicity and religion, matches the participant to an in-group and out-group according to the matching rule (discussed below), and attaches the necessary worksheets for the dictator games and the trust games to the participants' booklet. All these were done discretely. The participants were also asked not to open their booklets until they are told by the experiment leader. The participant receives the booklet and stickers with their assigned identification numbers.

b. Booklets and Matching Rule

To facilitate the trust game, we prepared two types of booklets (A and B), and randomized the role assignment by letting the participants to choose between two stacks of booklets during sign-in. Our primary research question was to study whether the participants exhibit patterns of in-group favoritism and out-group bias based on their religious and ethnic identities.   For religion, we focus on the differences between Muslim and non-Muslims (Chritians). For ethnic groups, we selected the four major Muslim ethnicities and the four major non-Muslim identities. We designed a matching matrix (Table 2) which was used to match each participant an in-group and out-group partners for the dictator and trust games (discussed further below).

Table 2.

MIXED or PURE MUSLIM SESSIONS					
Who	Version	D1 (same religion/unkn)	D2 (other religion/unkn)	D3 (in-group)	D4 (out-group)
Muslim/ Maranao	V1	Muslim/ Unknown	Christian/ Unknown	Muslim/Maranao	Muslim/Maguindanao
	V2				Muslim/Tausug
	V3				Muslim/Yakan
Muslim/ Maguindanao	V4	Muslim/ Unknown	Christian/ Unknown	Muslim/Maguindanao	Muslim/Maranao
	V5				Muslim/Tausug
	V6				Muslim/Yakan
Muslim/ Tausug	V7	Muslim/ Unknown	Christian/ Unknown	Muslim/Tausug	Muslim/Yakan
	V8				Muslim/Maguindanao
	V9				Muslim/Maranao
Muslim/ Yakan	V10	Muslim/ Unknown	Christian/ Unknown	Muslim/Yakan	Muslim/Tausug
	V11				Muslim/Maguindanao
	V12				Muslim/Maranao
Christian/Any	V5c	Muslim/ Unknown	Christian/ Unknown	Muslim/Maguindanao	Muslim/Tausug
Christian/Any	V3c			Muslim/Maranao	Muslim/Yakan
Christian/Any	V2c			Muslim/Maranao	Muslim/Tausug
Christian/Any	V6c			Muslim/Maguindanao	Muslim/Yakan
Muslim/ Other*	V13	Muslim/ Unknown	Christian/ Unknown	Muslim/Other*	Muslim/Maranao
	V14				Muslim/Tausug
PURE CHRISTIAN SESSIONS					
Christian/ Tagalog	V15	Christian/ Unknown	Muslim/ Unknown	Christian/ Tagalog	Christian/Bisaya
Christian/ Cebuano	V16	Christian/ Unknown	Muslim/ Unknown	Christian/ Cebuano	Christian/Ilokano
Christian/ Ilokano	V17	Christian/ Unknown	Muslim/ Unknown	Christian/ Ilokano	Christian/Cebuano
Christian/ Bisaya	V18	Christian/ Unknown	Muslim/ Unknown	Christian/ Bisaya	Christian/Tagalog
Christian/Other*	V19	Christian/ Unknown	Muslim/ Unknown	Christian/Other*	Christian/Tagalog

* Use stamps for Muslim/same ethnicity because decision 3 is empty

Note: Peaceful (Maranao, Maguindanao)-Conflict (Tausug, Yakan)

c. Experiment Room/Area

Once the sign-in process is completed, the participants were directed to the experiment area, where they were given the consent form and the PhP100 show up fee. They were informed that they were free to leave if they choose to do so. Most of the participants agreed to stay for the duration of the experiment.[4]

The experiments were all done in paper and pencil format. We used a format similar to Whitt and Wilson (2007). All sessions were facilitated by one experimental leader and two to four research assistants. The experimental gave instructions and examples based on a standard

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[4] One participant in Site 2 left before the start of the session due to an emergency; another participant in Site 3 left during the experiment.

script that was used for all sessions. To provide a visual guide on how to properly mark their choices, the leader used huge posters replicating the booklet pages for each task.

d. Tasks

The experiment involved five tasks: risk preference game, time preference measure, dictator game, public good game and trust game. At the end of the session one task was randomly chosen for payment.

The risk preference game (Picture in Appendix __) asked participants to choose between six lotteries. Each lottery has a low and high amount; the participants were informed that if this task was chosen for payment, they would be asked to draw from an envelope that has "high" and "low" cards. If they draw the "high" card, they would receive the high amount in the lottery they chose; if they draw the "low' card, they would get the lower amount.

In the time preference game (Picture in Appendix __), the participants were asked to choose between getting a smaller amount of money the next day or a larger amount of money six months later. They were asked to make the choice six times; each choice has the payoff of PhP500 for the amount to be received the next day but has an increasing amount (PhP550 to PhP2000) for the amount to be received six months later.

The dictator game has four parts. For each one, the participant was asked to divide PhP300 between himself and another participant. The first two games were designed to measure in-group/out-group preference based on religion. In the first game, the partner is a person with the same religion; in the second game, the partner is a person of another religion (eg. If the participant is Muslim, the partner in 1 would be Muslim while the partner in 2 would be Christian). Games 3 and 4 were designed to test in-group/out-group preference based on ethnicity. We designed a matrix for various ethnicity matches as shown in Table 2. For

example, a Muslim who is Maranao can have booklet versions 1 to 3; if he/she received version 1, the partner in dictator game 4 is a Maguindanao. For version 2, the partner is Tausog and for version 3, Yakan. The versions are randomly assigned, i.e., the first Maranao who signs in gets version 1, the second, version 2 and so forth.   The matching was designed so we could make comparisons among various ethnic out-groups. The participants were informed that the partners were also part of the experiment, but may or may not be in the same session.

The public goods game is a voluntary contribution mechanism (VCM) format.   In this task, participants were asked to allocate PhP300 between his own pocket and a group fund. Each group is composed of the participant and three other people from the session. The money sent to the group fund was doubled and divided equally among the members. If this task was chosen for payment, we randomly grouped the participants in groups of four to calculate the payoffs. No matching by religion or ethnicity was done for this task. The participants were nonetheless informed about the general makeup of the session according to religion and ethnicity. At the start of the session, the participants were informed of the distribution of participants present by religion and ethnicity. A poster showing the number of participants belonging to each religion and ethnicity was also visibly posted at the front of the experiment room during the entire experiment.

The last task is a binary trust game (Picture in Appendix ____).   At this point, the participants were informed of their role as either A or B; the booklets differ depending on the participant's role.   Person A has the option of choosing an even allocation (PhP300, PhP300) or to let B make a choice.   Person B has two choices: (PhP100, PhP900) or (PhP600, PhP400). There are four trust games with the same payoff structure, but different partners. The set-up of

the partners are the same as that of the dictator game, i.e., the partner in 1 is a religion in-group, in 2 a religion out-group, in 3 an ethnic in-group, and in 4, an ethnic out-group.

e. Expectations

After the five tasks, we elicited expectations for the VCM and the Trust Game by asking the participants how much they thought would another participant contribute to the group fund, and about what they expected their partner to choose for each of the four trust games.

f. Post-Survey

Once the tasks were completed, the experiment leader asks for a volunteer to draw from a box of numbers (1 to 5 corresponding to the tasks) to determine which task will be paid for the session. The booklets are then collected for review and payment calculation. While waiting for payment, the participants were asked to complete a survey designed to elicit various dimensions of the participant's cultural attitudes, sense of identification with their community, religion and ethnicity, as well as some demographic information.

g. Session Length and Earnings

The session lasted for two hours on average. The participants' earned PhP516 ($11) on average, which is roughly a day's wage in Manila.

Results (Preliminary)

a. Do Muslim and Christians differ in their risk attitudes, time preference and contribution to public goods?

One of our primary research interests was to examine whether religion has influence on people's economic behavior as exhibited by their risk attitudes, time preference and contribution to public goods. In this section we examine each of the said measures in turn.

In the risk preference game, we asked participants to choose among six lotteries Appendix __ shows the booklet images of the game. Each lottery has a low and high amount, each with 50% probability of realization. Figure __ shows the density of the ranked lotteries (1= 300, 300; 2=250,400; 3=200,500; 4=150, 600; 5=50, 700; 6=0,750). As can be seen from the density graphs of the risk preferences, there is no significant difference between the risk choices of the Christian and the Muslim participants in the experiments. In both groups, 21% opted to choose the lottery that gives them PhP 300 with certainty. Among the Christians, 5% chose the riskiest lottery that would give them PhP750 if the "high" scenario is realized and nothing if the "low" scenario is realized. Only 3% of the Muslim participants opted for the riskiest lottery. A two sample Kolmogorov-Smirnov test verified that the distribution of risk choices of the two groups is not significantly different from each other (K-S statistic=0.0228; p-value = 1.00). Hence, the Muslims and Christians in our experiment showed no differences in risk attitudes.

Figure __. Risk Preference by Religion

Risk Preference by Religion
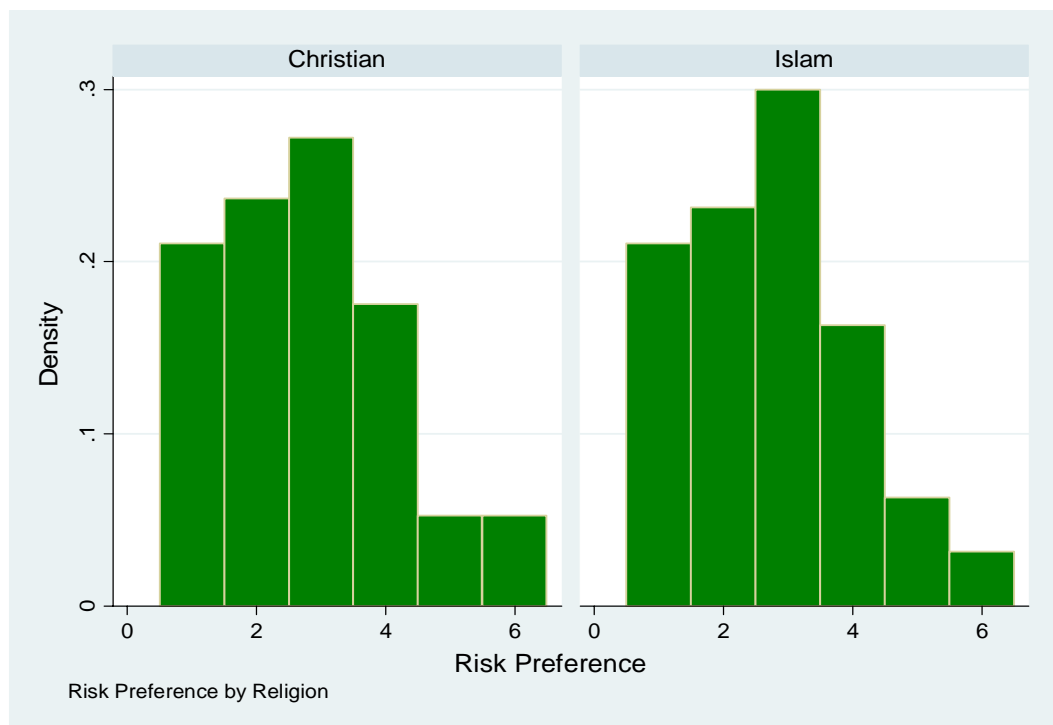
Similarly, we found no evidence of differences in time preference that follows religious demarcation. The time preference game (shown in Appendix __) asked participants to choose between PhP500 one day later and a larger amount six months later. They were asked to make this choice six times, with the amount to be received later increasing from PhP550 to PhP2000. Figure __ shows the graph of the participants' time preference choices, as illustrated by their switch points to the larger amount to be received at the later time.[5] Among the Islam population, 74% always chose the PhP500 to be received one day later; among the Christians, 72% made the same decision. The percentage of the participants who switched to the higher amount at decision six (PhP2000) was 12% among the Muslims and 16% among the Christians. The density of time preferences shows similar pictures for the two religions and a Kolmogorov-Smirnov test for equality of distribution verified the lack of independence of time preferences between the two religion groups (Combined K-S = 0.0249; p-value= 1.0).

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[5] That is, 1 denotes that the person always chooses the PhP500 in all six decisions, 2 denotes that the person switched to the higher amount (PhP600) at decision 2, 3 denotes that the person switched to the higher amount (PhP700) at decision 3, 4 denotes that the person switched to the higher amount (PhP1000) at decision 4, 5 denotes a switch to the higher amount (PhP1500) at decision 5 and 6 denotes a switch to the higher amount (PhP2000) at decision 6. Those who always chose the higher amount in all six decisions are coded 7.

Figure __. Time Preference by Religion

Time Preference by religion
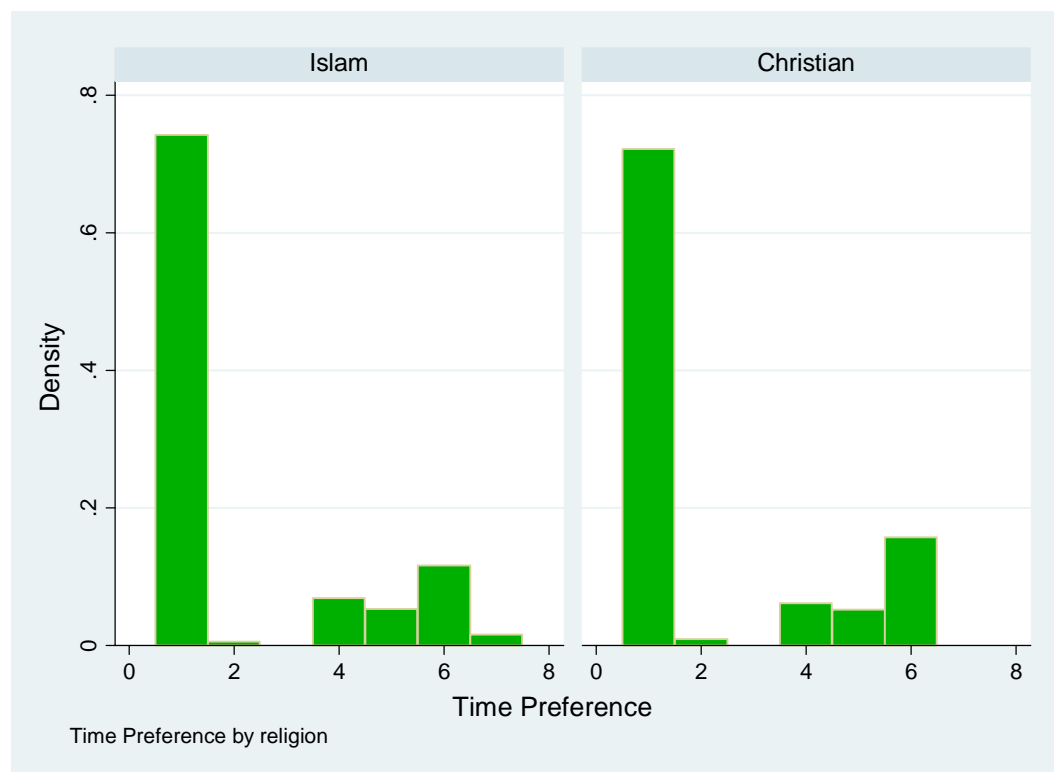
The amount sent to a public fund in the voluntary contribution mechanism (VCM) game also shows similar distribution between the two religions (Figure __). In this game, the participants were asked to allocate PhP300 between his/her own fund and that of a group fund. The discrete amounts that could be sent to the group fund were 0, PhP100, PhP200 and PhP300. For both religions, the majority sent PhP100. However, when we examined the determinants of the amount sent to the public fund with ordinary least squares, we found that Muslims tend to send significantly higher amount than Christians. The other explanatory variables included were demographic variables such as age, education status, marital status, location, session type (whether pure Muslim, pure Christian or mixed), household income level, savings behavior home ownership, and whether the participant was the primary income earner in his or her

household. None of the other said variables showed explanatory power except for the indicator for second location, Culiat, which is the lowest income community among our locations.

<Insert Table with VCM regression results about here>

In sum, we found no significant differences in risk and time preference choices that followed religious identity. However, we found some evidence that the Muslims in our experiment participants tend to send higher contribution to public goods.

b. Do people discriminate between religious and ethnic in-group and out-group member?

We examined our second research question by looking at the results of the Dictator Game (DG). Our dictator game was designed to assess the possibility of religious and ethnic in-group favoritism. The participants were asked to play four dictator games. In each instance, the participant is given PhP500 and is asked to divide the amount in any way between himself/herself and another person unknown to the participants. The recipient in the first dictator game (DG1) is a person of the same religion while that of the second dictator game (DG2) is of another religion (i.e., DG1 is for a religion in-group member while the DG2 is for a religion out-group member). In the third dictator game (DG3), the recipient is a person of the same religion and the same ethnicity; in the fourth dictator game (DG4), the recipient is a person of the same religion but different ethnicity.

The average amount sent in all four variants (Figure __) shows a bi-modal distribution with peaks at zero and PhP250. However, examination of the data showed no sign of in-group bias by religion. A t test of the equality of the means in DG1 and DG2 showed no significant difference among the Muslims (t=1.1162; d.f.= 190). Similarly, a t-test fo the equality of the means in DG1 and DG2 among the Christians yielded no significant difference between the

amounts sent to an in-group member and an out-group member (t=0.1506, d.f.=113). Figures __ and ___ shows the distribution of the amount sent in the four dictator games among Muslims and Christian, respectively. The distributions show no pattern of religious, nor ethnic in-group bias for both the Muslims and the Christians. However, when we examined the determinants of the differences in amount sent between religious in-group and out-group (amount sent in DG1 – amount sent in DG2), some interesting patterns emerged: the Muslims in the first location showed less in-group bias (significant at 5%), while the Muslims in the second location showed more in-group bias (significant at 5%).

<Insert Regression Tables of OLS Regression of the Determinants of DG1-DG2, by location>

Figure __. Distribution of Average Amount Sent in DG
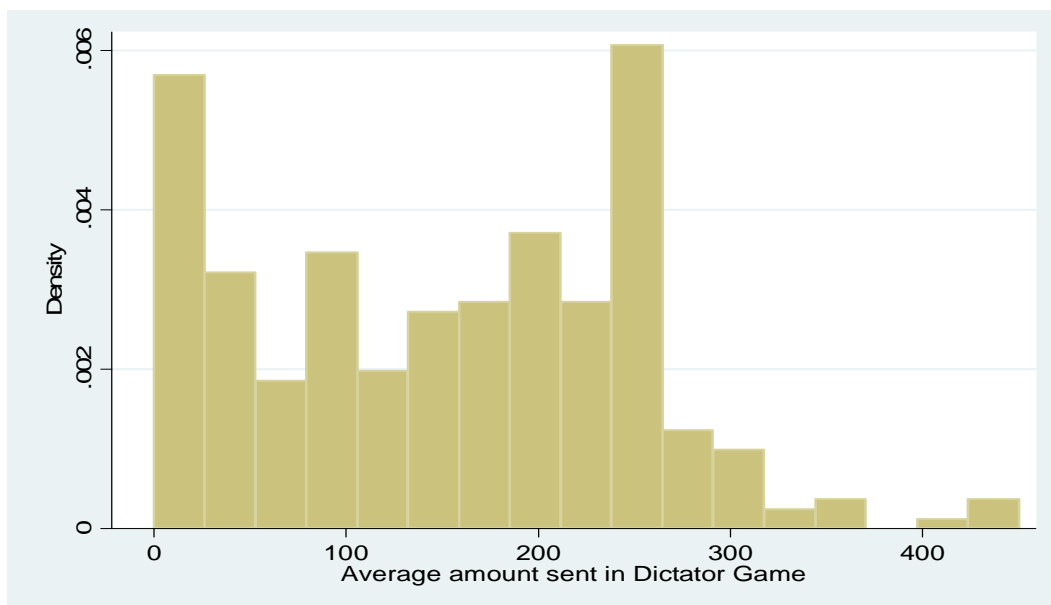
Figure ___. Distribution of Amount sent in DG among Muslim Participants
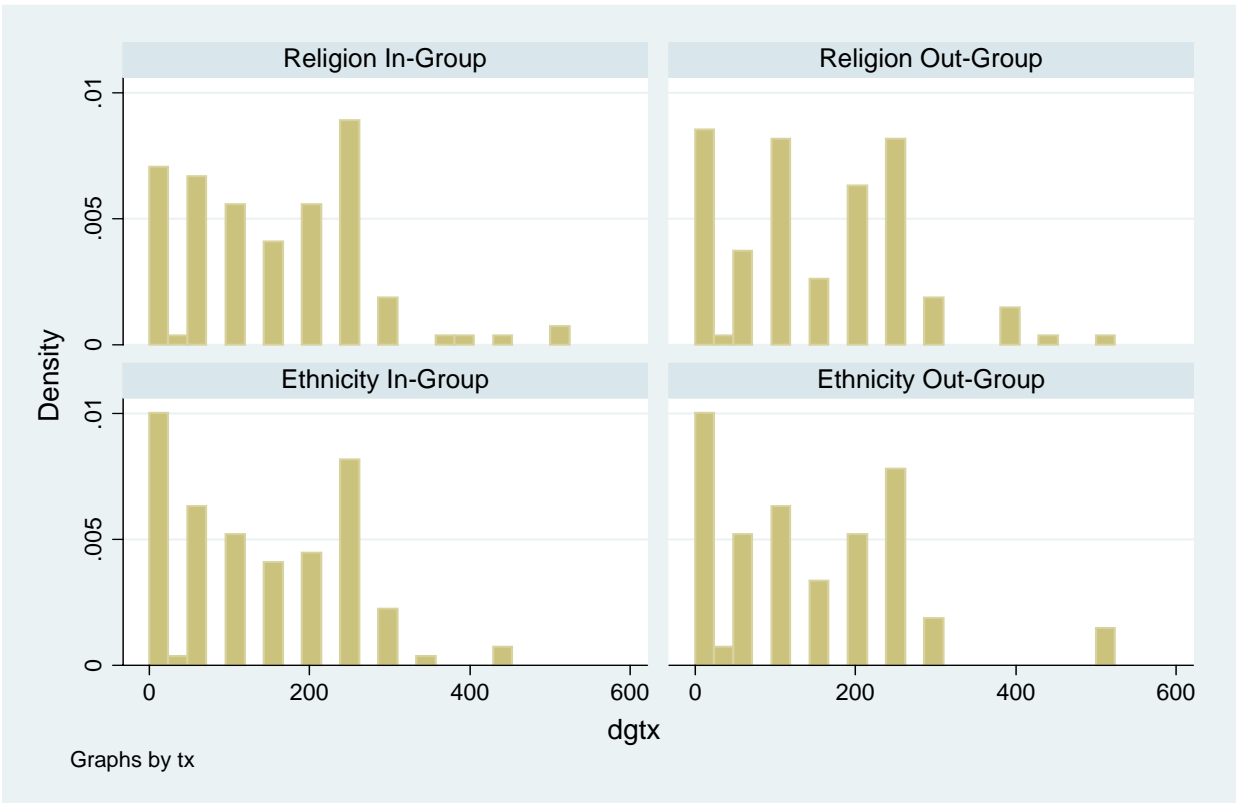
Figure__. Distribution of Amount Sent in DG among Christian Participants
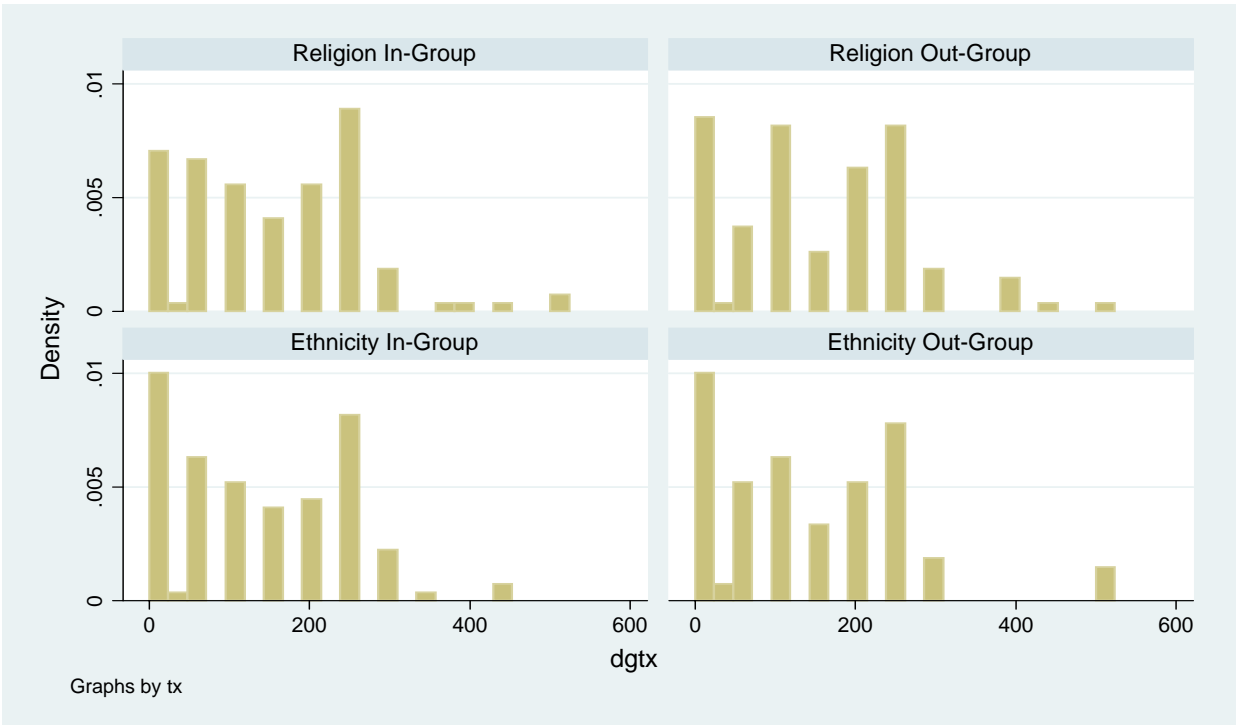
Conclusion

Our preliminary analysis shows that overall, there is no significant difference between our Muslim and Christian participants in terms of risk attitudes and time preference. The determinants of VCM contributions show that Muslims send more to public funds. Generally, our data showed no sign of religious or ethnic in-group favoritism as evidenced by the amounts sent to a stranger in our four variants of the dictator game. However, when disaggregated by location, our data shows some interesting pattern of religious in-group bias. The first location, Taguig, shows evidence of less religious in-group bias while the second location, Culiat, shows a slightly higher degree of religious in-group bias. Combined with the evidence of higher VCM contribution among participants in Culiat, it appears that this low-income segregated community may show higher degree of insularity. Furthermore, we found that demographic and economic characteristics do not strongly explain contribution to public goods or amounts sent to strangers in the dictator games.

Our results do not support either ascriptive theory nor the modernization theories hypothesized to explain patterns of behavior. Generally, our data showed no sign of religious or ethnic in-group favoritism as evidenced by the amounts sent to a stranger in our four variants of the dictator game. However, when disaggregated by location, our data shows slight in-group favoritism among the lowest income and highly segregated Muslim community (Culiat). It appears that there is no strong evidence of in-group favoritism and out-group discrimination that follows religious or ethnic divide. The level of assimilation and degree of a community's segregation may have an impact on the in-group/out-group bias. One important caveat is that our experiments were conducted in relatively peaceful Muslim communities in Manila and not in the conflict zones of Moro Mindanao. Our results, however, bodes well for possible policies for

negotiating peace among the conflicting regions in the South. Migrant Muslims in Metro Manila behave similar to their Christian counterparts and there is no strong evidence of in-group/out-group biases. Thus, modes of assimilation such as communication and contact among groups may have positive effect on peace negotiations.

References

Ahmed, A. M., 2008. Group identity, social distance and in-group bias. Journal of Economic Psychology 28, 324-337.

Akerlof, George A.; Kranton, Rachel E., 2005. Identity and the Economics of Organizations. Journal of Economic Perspectives 19 (1/Winter): 9-32.

Akerlof, George and Rachel Kranton, 2000. Economics and Identity, Quarterly Journal of Economics 115 (3): 715–753.

Andreoni, James and Ragan Petrie, 2008. Beauty, gender and stereotypes: Evidence from laboratory experiments, Journal of Economic Psychology 29, 73-93.

Ahn, T.K., Ostrom, E., Schmidt, D.,Walker, J., 2003. Trust in two-person games: game structures and linkages. In: Ostrom, E., Walker, J. (Eds.), Trust and Reciprocity. Interdisciplinary Lessons From Experimental Research. New York: Russell Sage Foundation, pp. 323–351.

Ashraf, N., Bohnet, I., Piankov, N., 2003. Decomposing trust. Mimeo, Kennedy School of Government, Harvard University.

Bahry, D., and R. Wilson, Ethnicity and trust: Evidence from Russia, in Working papers, Penn State, 2004.

Becker, Gary, The Economics of Discrimination (Chicago: University of Chicago Press, 1957).

Blackwell, Calvin and Michael McKee, 2003. Only for my own neighborhood? Preferences and voluntary provision of local and global public goods. Journal of Economic Behavior and Organization 52, 115-131.

Bernhard Helen, Ernst Fehr, and Urs Fischbacher,2006. Group Affiliation and Altruistic Norm Enforcement. American Economic Review, 96: 217-221

Benjamin, Daniel J., James J. Choi, and A. Joshua Strickland, 2007. Social Identity and Preferences, Working Paper 13309, http://www.nber.org/papers/w13309

Berg, J., J. Dickhaut, and K. McCabe, 1995. Trust, reciprocity, and social history, Games and Economic Behavior, 10: 122–142.

Bohnet, I., & Frey, B. (1999). The sound of silence in the prisoner's dilemma and dictator games. Journal of Economic Behavior and Organization, 38, 43–57.

Buchan Nancy R., and Rachel T.A. Croson 2004 The boundaries of trust: own and others' actions in the US and China. Journal of Economic Behavior and Organization, 55: 485-504

Buchan Nancy R., Eric J. Johnson and Rachel T.A. Croson 2005. Let's get personal: An international examination of the influence of communication, culture and social distance on other regarding preferences. Journal of Economic Behavior and Organization, article in press.

Bowles, S., Gintis, H., 2002. Social capital and community governance. Economic Journal 112, F419–F436.

Camerer, Colin F and Ernst Fehr. 2004.Measuring Social Norms and Preferences Using Experimental Games: A Guide for Social Scientist, in Foundations of Human Sociality, ed Joseph Hernrich, et.al., New York: Oxford University Press.

Capra, C. Mónica, Kelli Lanier, and Shireen Meer, 2008. Attitudinal and Behavioral measures of trust: a New Comparison, working paper

Chai, Sun-Ki, 2005. Predicting Ethnic Boundaries. *European Sociological Review.* 21 (4): 375-391.

Chai, Sun-Ki and Aaron Wildavsky, 2003. Culture, Rationality and Violence. In *Politics, Policy and Culture edited by Dennis J. Coyle and Richard J. Ellis* Westview Press, Ch.8.

Chai, Sun-Ki, 1996. A Theory of Ethnic Group Boundaries. *Nations and Nationalism* 2 (2): 281-307.

Chai, Sun-Ki, 1997. Rational Choice and Culture: Clashing Perspectives or Complementary Modes of Analysis? In *Culture Matters: Essay in Honor of Aaron Wildavsky ed. by Richard J. Ellis Michael Thompson.* Boulder Colorado: Westview. Ch.2.

Charness, G., Luca Rigotti and Aldo Rustichini, 2006. Individual Behavior and Group Membership, Mimeo

Chen, Yan and Xin Li, 2006. Group Identity and Social Preferences, American Economic Review, forthcoming

Chen, Yan, Sherry Li, Tracy Xiao Liu and Margaret Shih, 2008. Social Identity, Diversity and Stereotypes, working paper

Cox, James, 2004. Trust and reciprocity: implications of game triads and social context. Journal of Economic Behavior & Organization, 46: 260-281.

Croson, Rachel, Melanie Marks, and Jessica Snyder, "Groups Work for Women: Gender and Group Identity in the Provision of Public Goods," 2003. Working Paper, University of Pennsylvania, April 2003. http://opim.wharton.upenn.edu/~crosonr/research/%5B69%5D.pdf

Davis, John B., 2006. Social identity strategies in recent economics. Journal of Economic Methodology 13(3), 371-390.

Douglas, Mary and Aaron Wildavsky, 1982. Risk and Culture. *California U.P.*

Danielson, A., and H. Holm, 2007. Do you trust your brethren? Eliciting trust attitudes and trust behavior in a Tanzanian congregation, Journal of Economic Behavior & Organization, 62: 255-271.

Eckel, Catherine C., and Philip J. Grossman. 2005. Managing diversity by creating team identity. *Journal of Economic Behavior & Organization* 58: 371–392.

Ferraro, Paul J. and Ronald G. Cummings 2005. Cultural diversity, discrimination and economic outcomes: an experimental analysis. *Working paper*

Fehr, E., and S. Gachter, 2000. Cooperation and Punishment. American Economic Review, 90 (4): 980-994.

Fehr, E., U. Fischbacher, B.v. Rosenbladt, J. Schupp, and G. Wagner, 2002. A nation-wide laboratory -Examining trust and trustworthiness by integrating experiments in representative surveys. Schmollers Jahrbuch, 122: 519-542.

Fershtman, Chaim, and Uri Gneezy, 2001. Discrimination in a segmented society: experimental approach. Quarterly Journal of Economics, Feb., 351-377.

Fershtman, Chaim, Uri Gneezy, and Frank Verboven, 2005. Discrimination and nepotism: the efficiency of the anonymity rule. Journal of Legal Studies 34, 371-394.

Frey, B., & Meier, S. (2004). Pro-social behavior in a natural setting. Journal of Economic Behavior and Organization, 54, 65–88.

Gächter, S., B. Herrmann, and C. Thöni, 2004. Trust, voluntary cooperation, and socio-economic background: survey and experimental evidence. Journal of Economic Behavior & Organization 55: 505-531.

Gächter, S., Herrmann, B., 2003. Norms of cooperation among urban and rural dwellers. Experimental evidence from Russia. Mimeo, University of St. Gallen.

Gächter, S., Herrmann, B., Thöni, C., 2003. Understanding determinants of social capital: cooperation and informal sanctions in a cross-societal perspective. Mimeo, University of St. Gallen

Goette Lorenz, David Huffman, and Stephan Meier 2006.The Impact of Group Membership on Cooperation and Norm Enforcement: Evidence Using Random Assignment to Real Social Groups. American Economic Review, 96: 212-216

E. Glaeser, D. Laibson, J. Scheinkman and C. Soutter, 2000. Measuring trust. Quarterly Journal of Economics, 115: 811–846.

Habyarimana, James, Macartan Humphreys, Daniel N. Posner, Jeremy M. Weinstein, 2007. Why Does Ethnic Diversity Undermine Public Goods Provision? American Political Science Review, 101(4): 709-725

Halevy, Nir, Gary Bornstein, and Lilach Sagiv, 2008. ''In-group love'' and ''out-group hate'' as motives for individual participation in intergroup conflict: a new game paradigm. Psychological Science 19 (4), 405-411.

Henrich, Hoseph; Boyd, Robert; Bowles, Samuel; Camerer, Colin; Fehr Ernst; Gintis, Herbert and Richard McElreath. (2001). In Search of Homo Economicus: Behavioral Experiments in 15 Small-Scale Societies. American Economic Review 91(2), 73-78.

J. Henrich, R. Boyd, S. Bowles, C. Camerer, E.Fehr, and H. Gintis (eds.) 2004. Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies. Oxford University Press.

Hoff Karla and Priyanka Pandey, 2006. Discrimination, Social Identity, and Durable Inequalities. American Economic Review, 96 (2): 206-211.

Hoffman, E., McCabe, K., & Smith, V. (1996). Social distance and other regarding behavior in dictator games. American Economic Review, 86, 653–660.

Jin, N., Yamagishi, T. & Kiyonari, T., 1996. Bilateral dependency and the minimal group paradigm. The Japanese Journal of Pshychology 72, 77-85 (in Japanese with an English abstract).

Karp, D., Jin, N., Ymagishi, T. & Shinotsuka, H., 1993. Raising the minimum in the minimal group paradigm. Japanese Journal of Experimental Social Psychology 32, 231-240.

Kiyonari Toko, Yamagishi Toshio, Cook Karrn S., Cheshire Coye, 2006. Does trust beget trustworthiness? Trust and trustworthiness in two games and two cultures: A research note. Social Psychology Quarterly 69(3), 270-283.

Leider, Stephen, Markus M. M¨obius, Tanya Rosenblat, and Quoc-Anh Do, 2008. Directed altruism and enforced reciprocity in social networks. QJE forthcoming

Li, Xin, Angela C. M. de Oliveira, Catherine Eckel, 2008. Common Identity and the Voluntary Provision of Public Goods: An Experimental Investigation, working paper.

Ma, Leanne, Katerina Sherstyuk, Malcolm Dowling, Olivier Hill, 2002. Altruism and voluntary provision of public goods. Economics Bulletin, 3, 1−8

McLeish, Kendra N. and Robert J. Oxoby, 2007, Identity, Cooperation and Punishment, *Mimeo*

Newman, Saul, 1991. Does Modernization Breed Ethnic Political Conflict? *World Politics*, 43 (3): 451-478.

Sherif, Muzafer; Harvey, O. J.; White, B. Jack; Hood, William R. and Sherif, Carolyn W., 1961. Intergroup conflict and cooperation: The robbers cave experiment. Norman, OK: University of Oklahoma Book Exchange.

Solow, J.L. and N. Kirkwood 2002. Group identity and gender in public goods experiments. Journal of Economic Behavior and Organization, 48: 403–412

Swee-Hoon Chuaha, Robert Hoffmann,Martin Jones, Geoffrey Williams Do cultures clash? Evidence from cross-national ultimatum game experiments. Journal of Economic Behavior & Organization Vol. 64: 35–48

Tajfel, Henri and John Turner, An Integrative Theory of Intergroup Conflict, in Stephen Worchel and William Austin, eds., The Social Psychology of Intergroup Relations, Monterey, CA: Brooks/Cole, 1979.

Tajfel, H. (1978). Differentiation between social groups: Studies in the social psychology of intergroup relations. London: Academic Press.

Tanaka, Tomomi, Colin Camerer and Quang Nguyen, Risk and time preferences: Experimental and household data from Vietnam. Forthcoming in the American Economic Review

Ymagishi, T., Makimura, Y., Foddy, M., Matsuda, M., Kiyonari, T., & Platow, M. J., 2005. Comparisons of Australians and Japanese of group-based cooperation. Asian Journal of Social Psychology 8, 173-190.

Weber, Roberto and Colin Camerer 2003 Cultural Conflict and Merger Failure: An Experimental Approach, *Management Science* 49 (4): 400-415.

Wachsman , Yoav , 2002. The effect of intragroup communications in public good experiments with nested exchanges, dissertation, University of Hawaii at Manoa

Wichardt, Phillip C., 2008. Identity and why we cooperate with those we do? Journal of Economic Psychology 29, 127-139.

Philippine Field Experiments

September 1 - October 6, 2009

Sites and timeline

- Taguig
  - Preparation and training (Aug 25 to Sep 7)
  - Pilot (Sep 8)
  - Experiments (Sep 9 to 14)
  - Extra Session (Oct 6)
- Culiat
  - Experiments (Sep 15 to 22)
- Greenhills
  - Experiments (Sep 25 to Oct 2)

Taguig

Culiat

Greenhills

Training

Taguig Sessions

Culiat Sessions

Greenhills Sessions

On the road

RAs

Sample Description (continued)

- Distribution by ethnicity
  - Maranao = 85 (27.8%)
  - Maguindanao = 31 (10.1%)
  - Tausog = 36 (11.2%)
  - Yakan = 15 (4.9%)
  - Balik Islam = 17 (5.6%)
  - Other Muslim (Iranon/Kalagan/Samal) = 8 (2.6%)
  - Tagalog = 52 (17.0%)
  - Cebuano = 14 (5.0%)
  - Ilocano = 12 (4.0%)
  - Bisaya = 14 (5.0%)
  - Ilonggo = 10 (3.0%)
  - Other Christian (Bicolano/Waray/Kapampangan) = 12 (4.0%)

Sample Description

- Number of participants
  - 328 (including pilot)
  - 306 (excluding pilot)
- Distribution by site
  - Taguig = 102 (33.3%)
  - Culiat = 104 (34.0%)
  - Greenhills = 100 (32.7%)
- Distribution by religion
  - Islam = 192 (62.6 %)
  - Christian = 114 (37.3%)

Games

- Risk Preference
- Time Preference
- Dictator Game (In-Group/Out-Group)
- VCM
- Trust Game (In-Group/Out-Group)

Risk Preference

Risk Preference by Religion

Graphs by religion
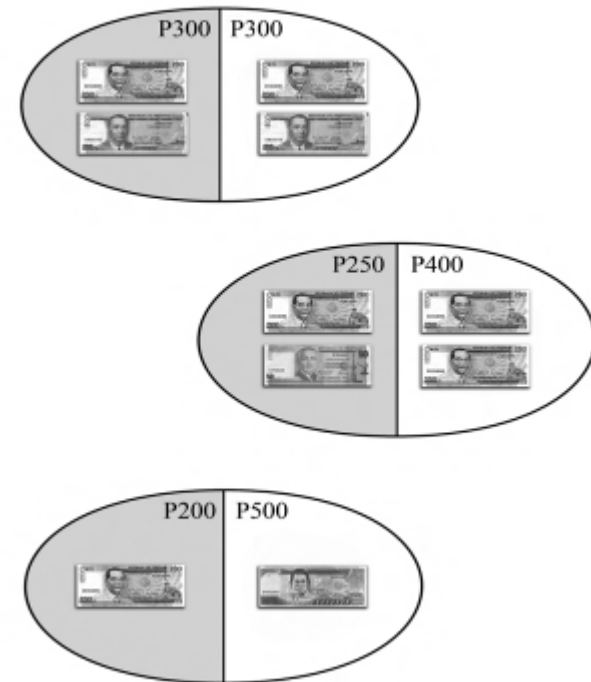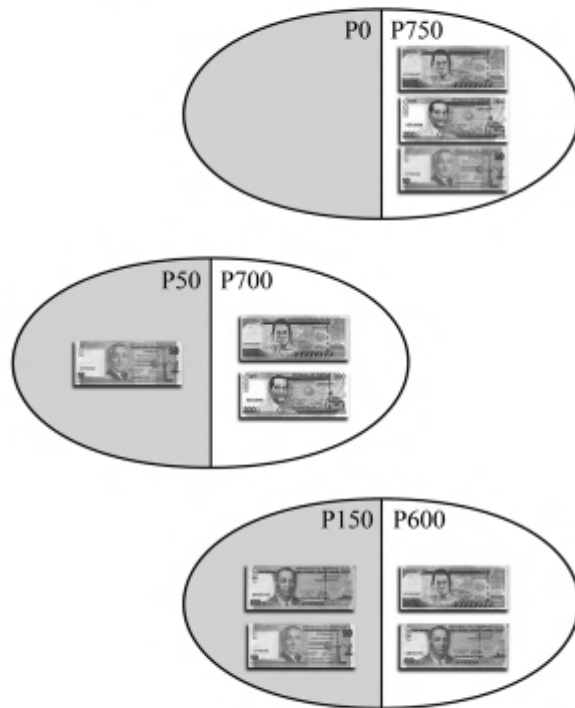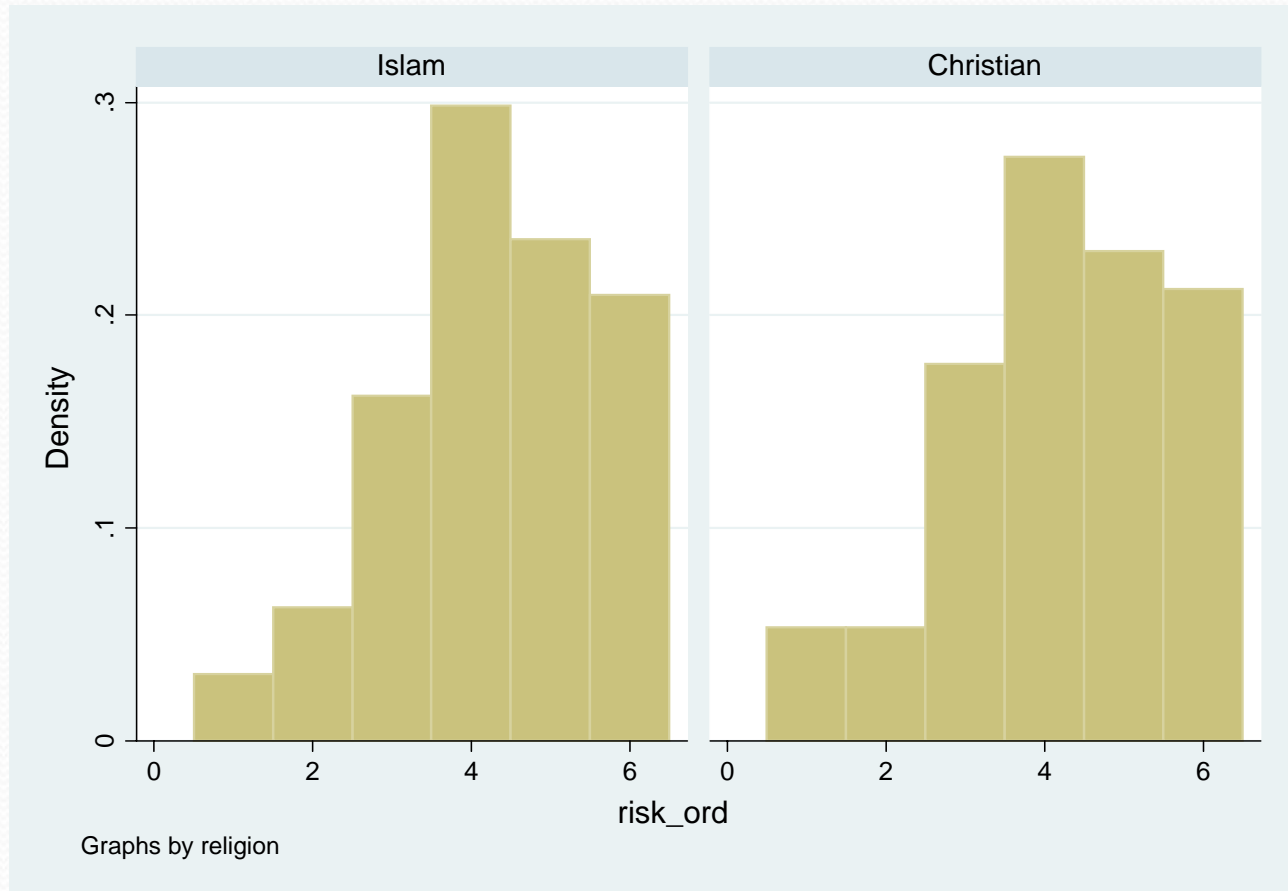
Risk Preference by ethnicity

Graphs by eth2
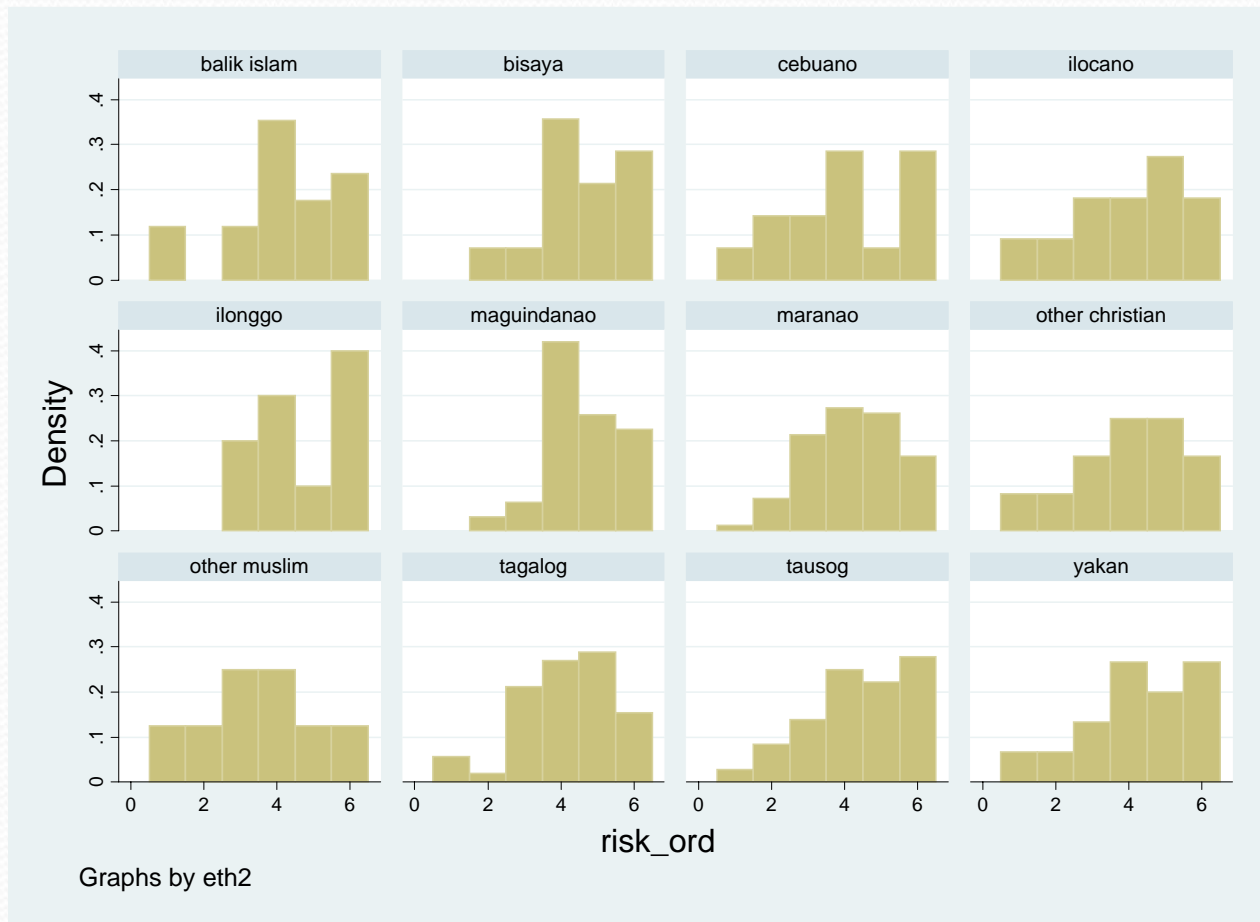
Time Preference

	Perang Matatanggap Bukas		Perang Matatanggap anim (6) na buwan buhat bukas	
1		₱500 ☐	☐₱550	
2		₱500 ☐	☐₱600	
3		₱500 ☐	☐₱700	
4		₱500 ☐	☐₱1000	
5		₱500 ☐	☐₱1500	
6		₱500 ☐	☐₱2000	

Time Preference by Religion

Graphs by religion

Time Preference by ethnicity

Graphs by eth2

Dictator Game

In-Group/Out-Group Setup

MIXED or PURE MUSLIM SESSIONS					
Who	Version	D1 (same religion/unkn)	D2 (other religion/unkn)	D3 (in-group)	D4 (out-group)
Muslim/ Maranao	V1	Muslim/ Unknown	Christian/ Unknown	Muslim/Maranao	Muslim/Maguindanao
	V2				Muslim/Tausug
	V3				Muslim/Yakan
Muslim/ Maguindanao	V4	Muslim/ Unknown	Christian/ Unknown	Muslim/Maguindanao	Muslim/Maranao
	V5				Muslim/Tausug
	V6				Muslim/Yakan
Muslim/ Tausug	V7	Muslim/ Unknown	Christian/ Unknown	Muslim/Tausug	Muslim/Yakan
	V8				Muslim/Maguindanao
	V9				Muslim/Maranao
Muslim/ Yakan	V10	Muslim/ Unknown	Christian/ Unknown	Muslim/Yakan	Muslim/Tausug
	V11				Muslim/Maguindanao
	V12				Muslim/Maranao
Christian/Any	V5c	Muslim/ Unknown	Christian/ Unknown	Muslim/Maguindanao	Muslim/Tausug
Christian/Any	V3c			Muslim/Maranao	Muslim/Yakan
Christian/Any	V2c			Muslim/Maranao	Muslim/Tausug
Christian/Any	V6c			Muslim/Maguindanao	Muslim/Yakan
Muslim/ Other*	V13	Muslim/ Unknown	Christian/ Unknown	Muslim/Other*	Muslim/Maranao
	V14				Muslim/Tausug
PURE CHRISTIAN SESSIONS					
Christian/ Tagalog	V15	Christian/ Unknown	Muslim/ Unknown	Christian/ Tagalog	Christian/Bisaya
Christian/ Cebuano	V16	Christian/ Unknown	Muslim/ Unknown	Christian/ Cebuano	Christian/Ilokano
Christian/ Ilokano	V17	Christian/ Unknown	Muslim/ Unknown	Christian/ Ilokano	Christian/Cebuano
Christian/ Bisaya	V18	Christian/ Unknown	Muslim/ Unknown	Christian/ Bisaya	Christian/Tagalog
Christian/Other*	V19	Christian/ Unknown	Muslim/ Unknown	Christian/Other*	Christian/Tagalog

* Use stamps for Muslim/same ethnicity because decision 3 is empty
Note: Peaceful (Maranao, Maguindanao)-Conflict (Tausug, Yakan)

CCPV Final Performance Report
- Appendix M

DG, In-Group/Out-Group Muslims

Graphs by tx
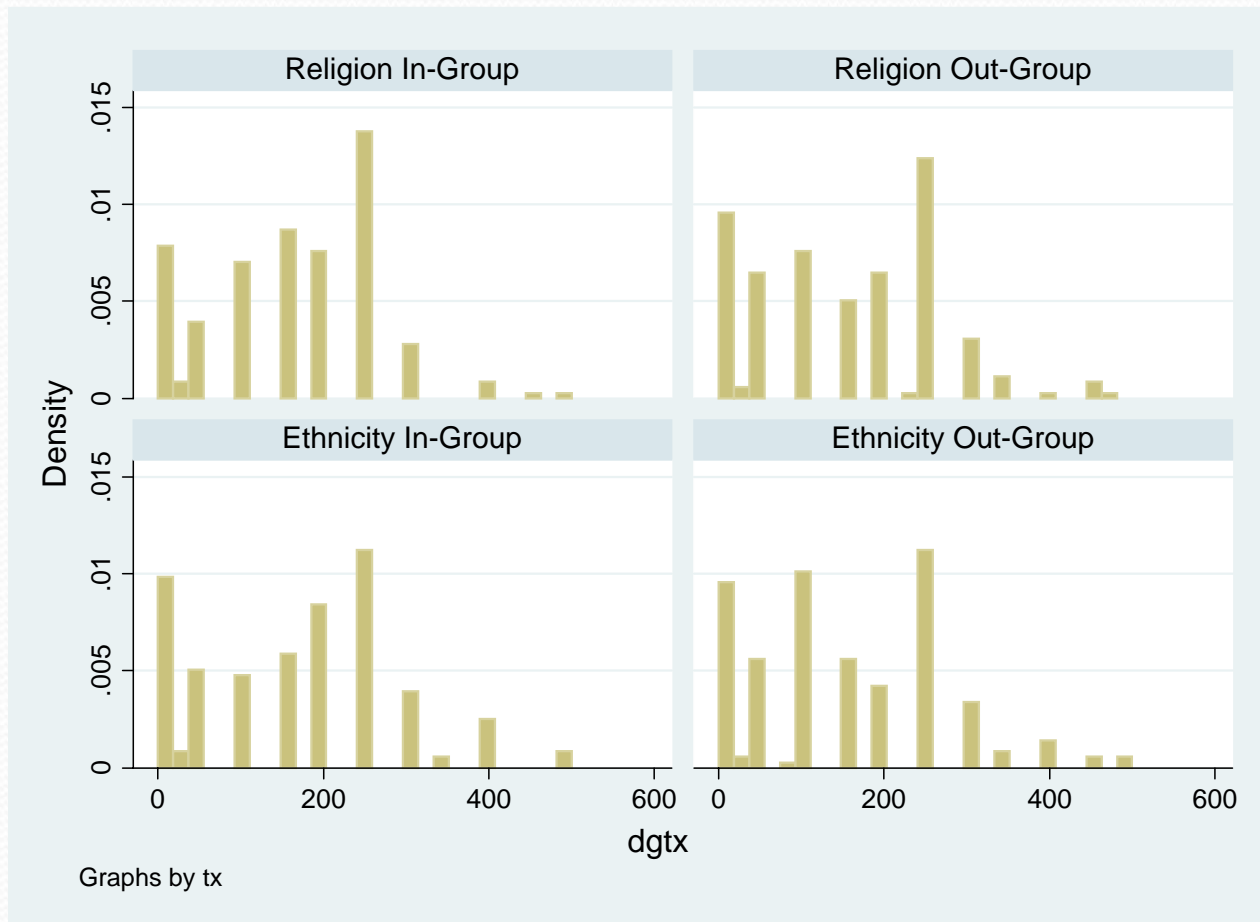
DG, In-Group/Out-Group Christians

Graphs by tx

DG, Maranao

Graphs by tx

DG, Maguindanao

Graphs by tx

DG, Tausog

Graphs by tx

DG, Yakan

Graphs by tx
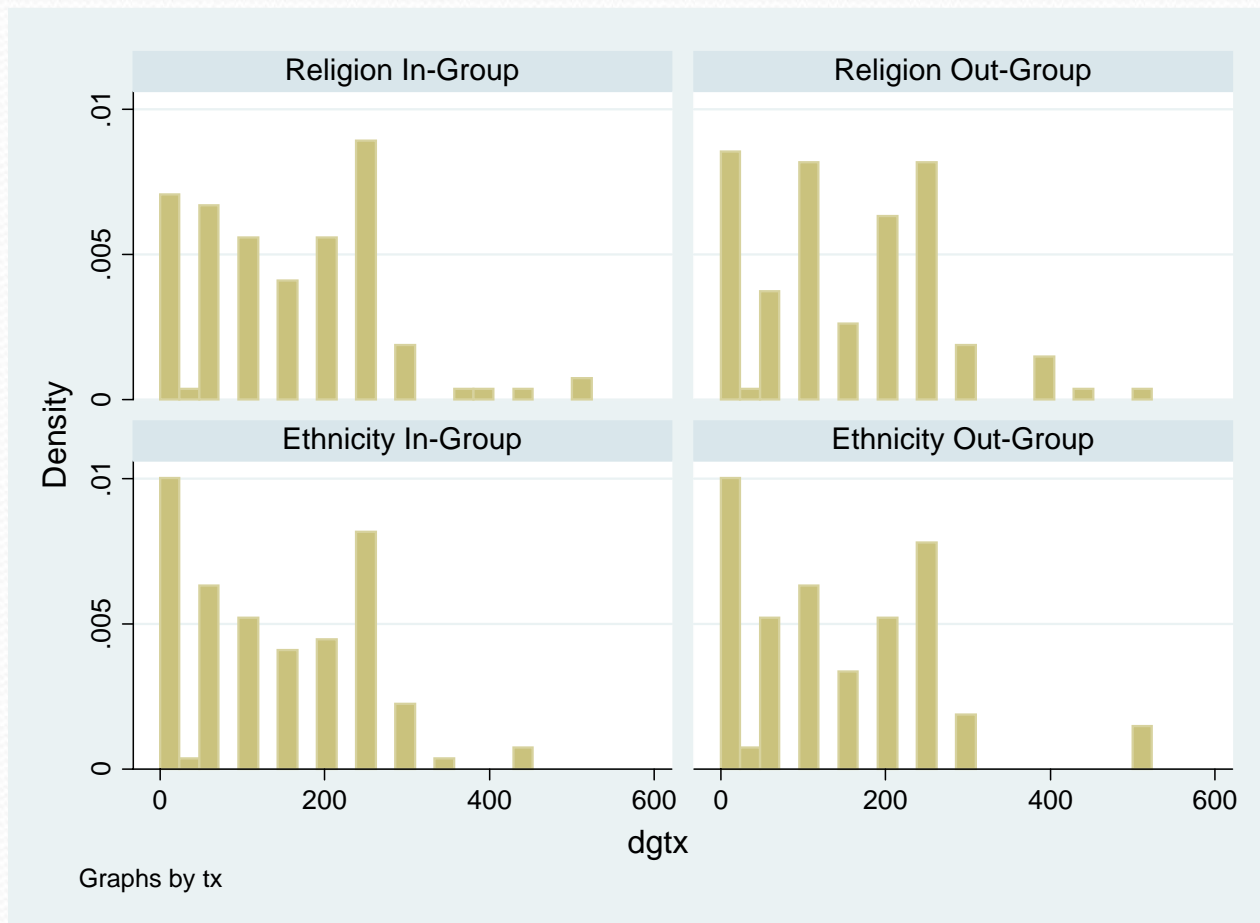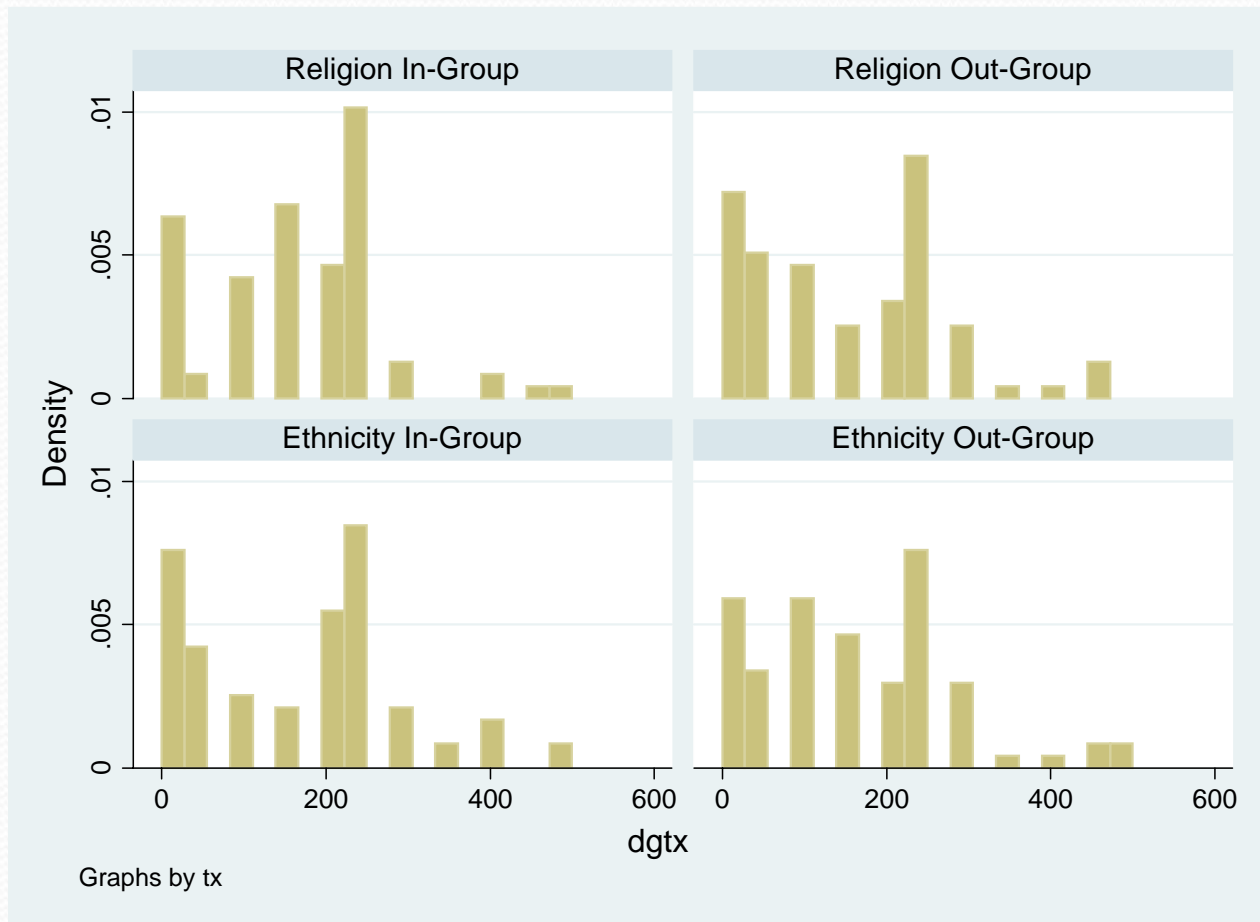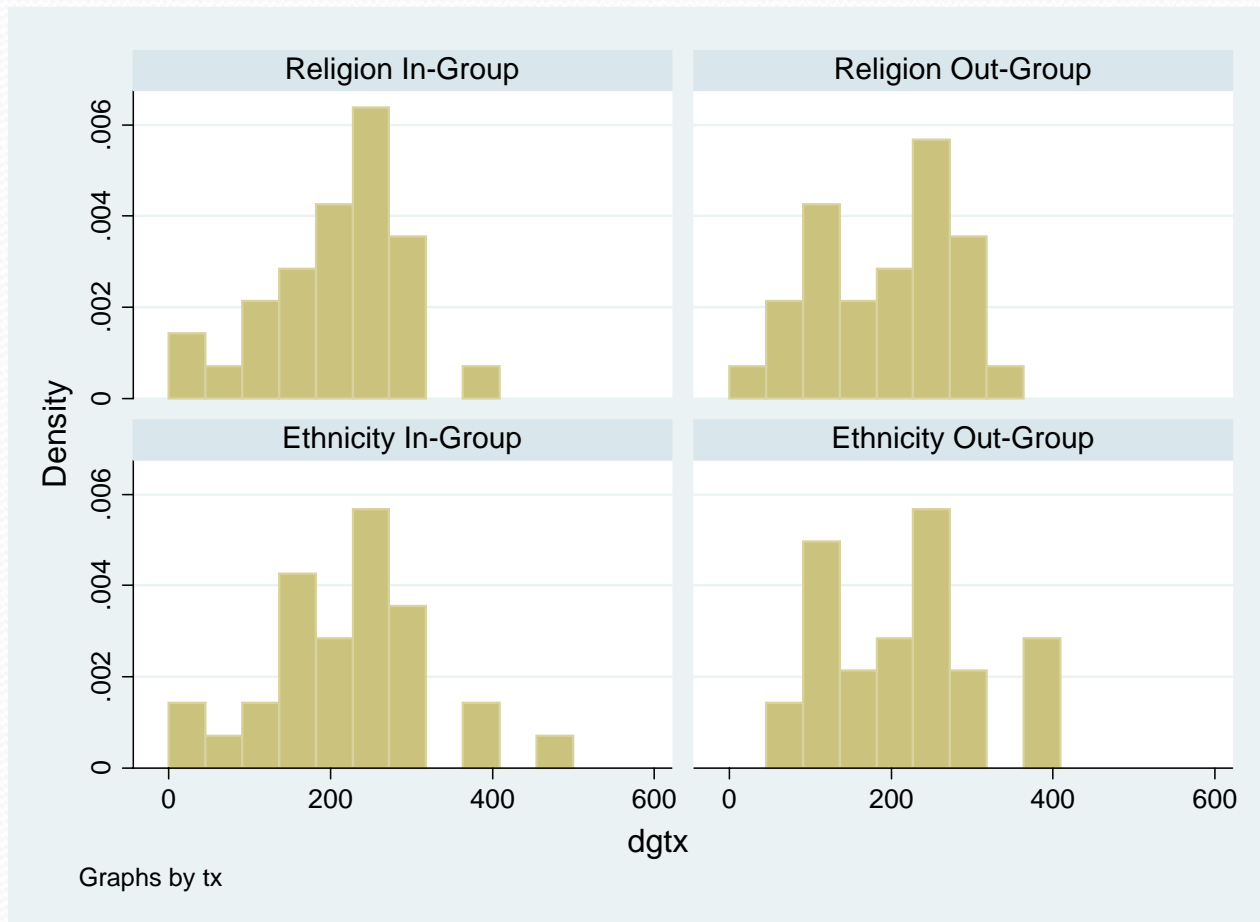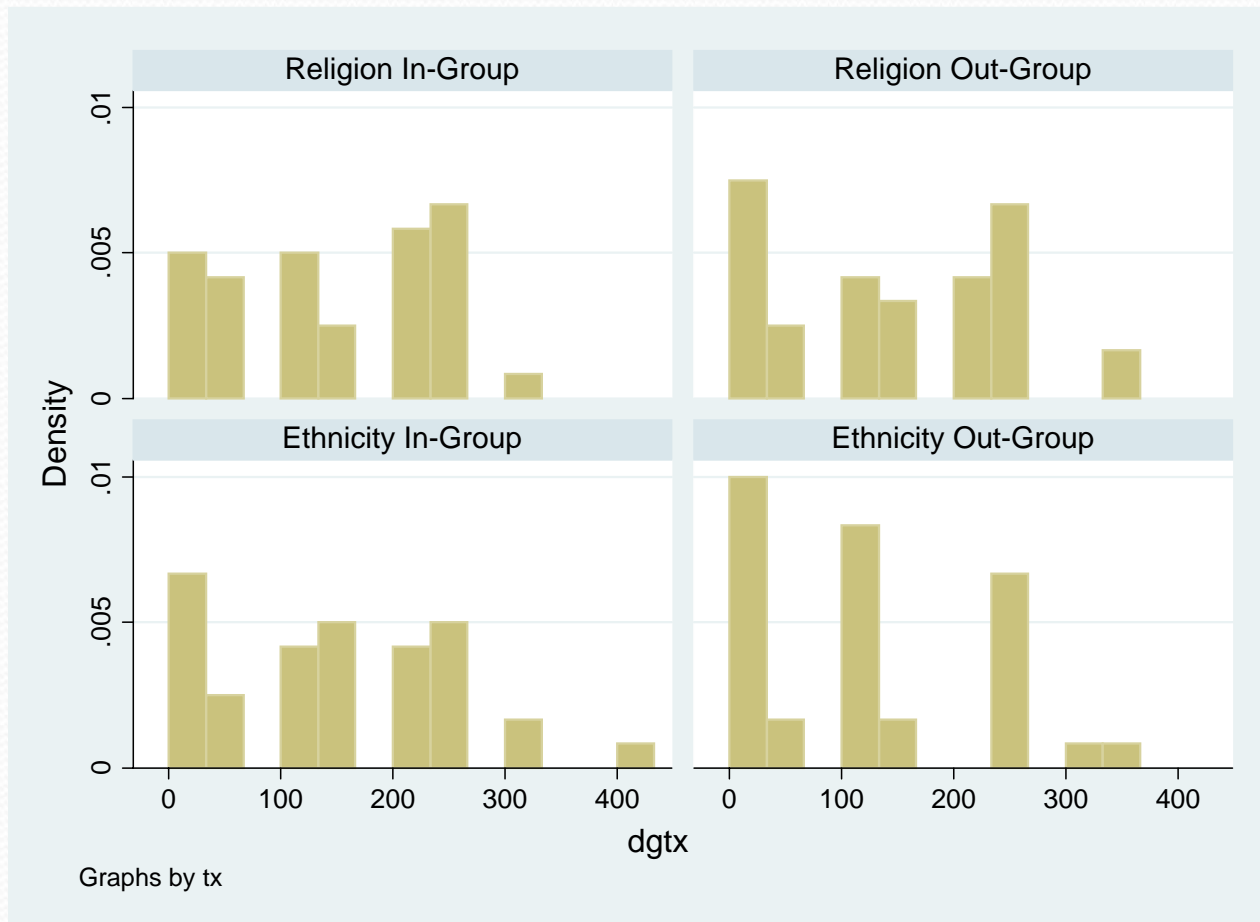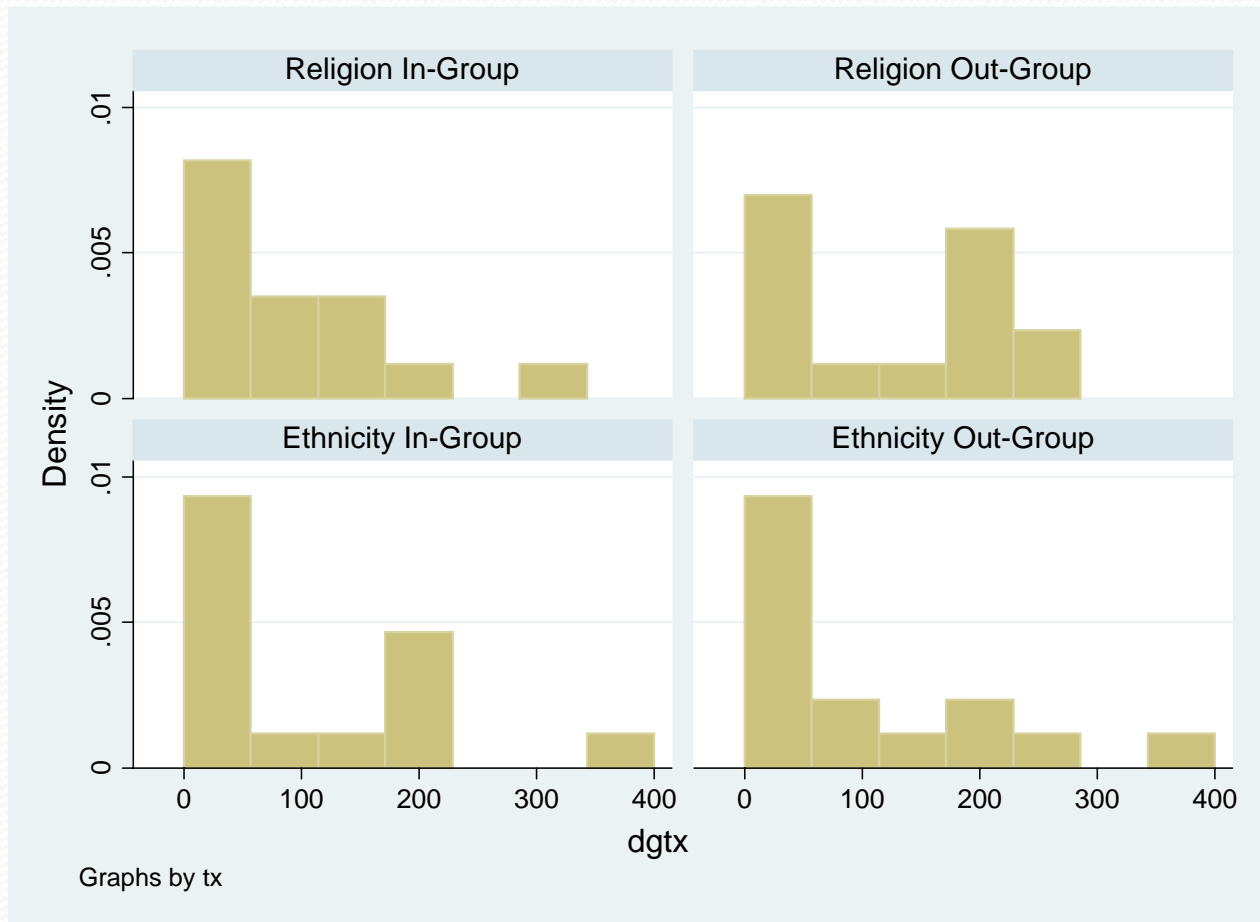
Preliminary Analysis (DG3)

- `.reg dg3 muslim`

```
      Source |       SS       df       MS              Number of obs =     305
-------------+------------------------------           F(  1,   303) =    5.82
       Model |  80544.8165      1  80544.8165           Prob > F      =  0.0164
    Residual |   4193184.2    303  13838.8917           R-squared     =  0.0188
-------------+------------------------------           Adj R-squared =  0.0156
       Total |  4273729.02    304  14058.3191           Root MSE      =  117.64


-----------------------------------------------------------------------------
         dg3 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+---------------------------------------------------------------
      muslim |   33.64952   13.94796     2.41   0.016     6.202386    61.09666
       _cons |   132.0796   11.06653    11.94   0.000     110.3027    153.8566
-----------------------------------------------------------------------------
```

Preliminary Analysis (DG1)

```
. reg dg1  maranao maguindanao tausog balik_islam other_muslim tagalog bisaya cebuano
ilocano ilonggo other_christian

      Source |       SS       df       MS              Number of obs =     305
-------------+------------------------------           F( 11,   293) =    2.21
       Model |  270017.406     11  24547.0369           Prob > F      =  0.0142
    Residual |  3260175.54    293   11126.879           R-squared     =  0.0765
-------------+------------------------------           Adj R-squared =  0.0418
       Total |  3530192.95    304  11612.4768           Root MSE      =  105.48


------------------------------------------------------------------------------
         dg1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     maranao |    76.2549   29.54144     2.58   0.010     18.1146    134.3952
 maguindanao |   109.8925   33.17715     3.31   0.001     44.59673   175.1882
      tausog |    45.55556  32.41715     1.41   0.161    -18.24443   109.3555
  balik_islam |   24.31373  37.36729     0.65   0.516    -49.22859   97.85604
 other_muslim |  106.6667   46.18064     2.31   0.022     15.77885   197.5545
     tagalog |    53.30128  30.91554     1.72   0.086    -7.543382   114.1459
      bisaya |    72.05128  39.97131     1.80   0.072    -6.615993   150.7186
     cebuano |    99.52381  39.19909     2.54   0.012     22.37633   176.6713
     ilocano |       16.25  40.85379     0.40   0.691    -64.15407   96.65407
     ilonggo |    76.66667  43.06367     1.78   0.076    -8.086664    161.42
  other_chri~n |  19.16667  40.85379     0.47   0.639     -61.2374   99.57074
       _cons |    93.33333  27.23586     3.43   0.001     39.73062    146.936
------------------------------------------------------------------------------
```
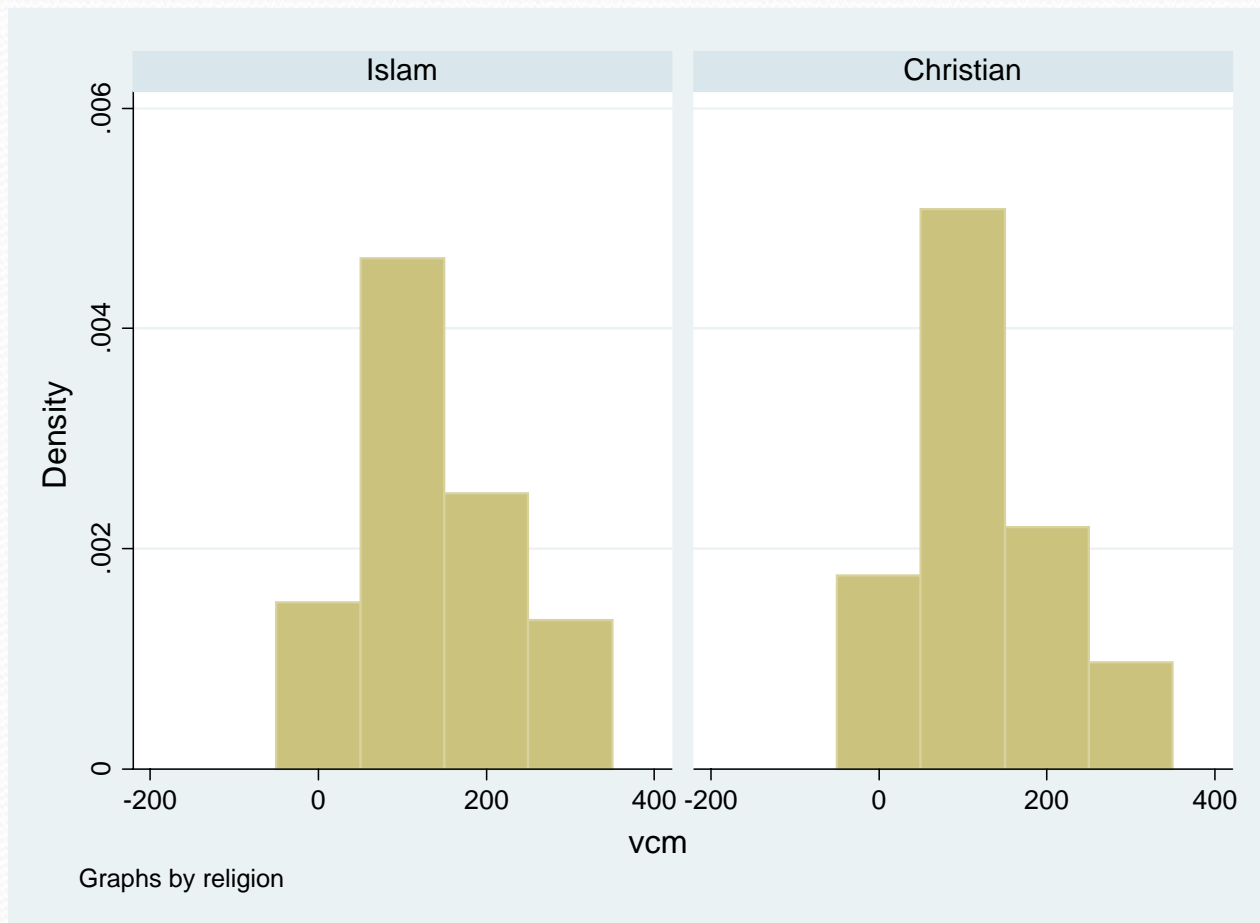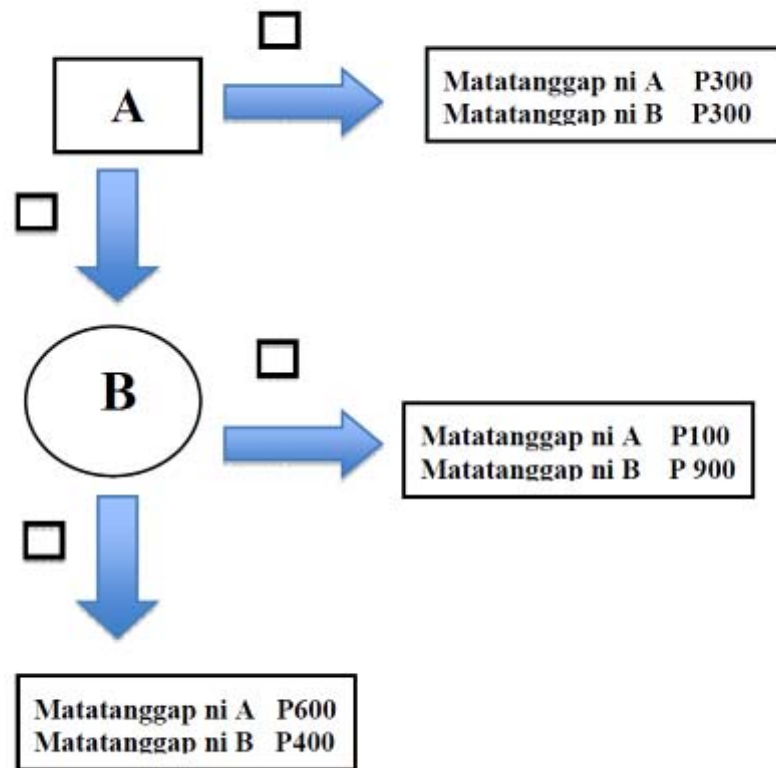
Preliminary Analysis (DG2)

. reg dg2 maranao maguindanao tausog balik_islam other_muslim tagalog bisaya cebuano ilocano ilonggo other_christian

```
      Source |       SS       df       MS              Number of obs =     305
-------------+------------------------------           F( 11,   293) =    0.99
       Model |  142158.372     11  12923.4883          Prob > F      =  0.4511
    Residual |  3806355.56    293  12990.9746          R-squared     =  0.0360
-------------+------------------------------           Adj R-squared = -0.0002
       Total |  3948513.93    304  12988.5327          Root MSE      =  113.98


------------------------------------------------------------------------------
         dg2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     maranao |   33.15686   31.92021     1.04   0.300    -29.6651     95.97882
 maguindanao |   67.04301   35.84869     1.87   0.062    -3.510564    137.5966
      tausog |   15.83333   35.02749     0.45   0.652    -53.10405    84.77072
 balik_islam |   7.745098   40.37623     0.19   0.848    -71.7191     87.20929
other_muslim |   47.08333   49.89927     0.94   0.346    -51.12309    145.2898
     tagalog |   30.73718   33.40496     0.92   0.358    -35.00691    96.48126
      bisaya |   20.64103   43.18994     0.48   0.633    -64.36081    105.6429
     cebuano |   78.33333   42.35554     1.85   0.065    -5.026327     161.693
     ilocano |   .4166667   44.14347     0.01   0.992    -86.46181    87.29515
     ilonggo |   23.33333   46.53131     0.50   0.616    -68.24463    114.9113
other_chri~n |  -13.33333   44.14347    -0.30   0.763    -100.2118    73.54515
        _cons |   121.6667   29.42898     4.13   0.000     63.74768    179.5857
------------------------------------------------------------------------------
```

.

Preliminary Analysis (DG3)

- `. reg dg3 maranao maguindanao tausog balik_islam other_muslim tagalog bisaya cebuano ilocano ilonggo other_christian`

```
      Source |       SS       df       MS              Number of obs =     305
-------------+------------------------------            F( 11,   293) =    2.02
       Model |  300894.583     11   27354.053           Prob > F      =  0.0267
    Residual |  3972834.43    293  13559.1619           R-squared     =  0.0704
-------------+------------------------------            Adj R-squared =  0.0355
       Total |  4273729.02    304  14058.3191           Root MSE      =  116.44


------------------------------------------------------------------------------
         dg3 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     maranao |   64.78431   32.61079     1.99   0.048     .6032298    128.9654
 maguindanao |   115.3763   36.62426     3.15   0.002     43.29638    187.4563
      tausog |   36.94444    35.7853     1.03   0.303    -33.48437    107.3733
 balik_islam |    55.4902   41.24975     1.35   0.180    -25.69317    136.6736
other_muslim |   77.91667   50.97881     1.53   0.127     -22.4144    178.2477
     tagalog |   36.08974   34.12766     1.06   0.291    -31.07668    103.2562
      bisaya |   35.12821   44.12433     0.80   0.427     -51.7126     121.969
     cebuano |   57.38095   43.27188     1.33   0.186    -27.78215    142.5441
     ilocano |      -6.25    45.0985    -0.14   0.890    -95.00805    82.50805
     ilonggo |   31.66667   47.53799     0.67   0.506    -61.89254    125.2259
 other_chri~n |  -10.83333   45.0985    -0.24   0.810    -99.59139    77.92472
        _cons |   103.3333   30.06566     3.44   0.001      44.1613    162.5054
------------------------------------------------------------------------------
```

Preliminary Analysis (DG4)

- . reg dg4 maranao maguindanao tausog balik_islam other_muslim tagalog bisaya cebuano ilocano ilonggo other_christian

```
      Source |       SS       df       MS              Number of obs =     305
-------------+------------------------------           F( 11,   293) =    2.30
       Model | 342030.442     11  31093.6765           Prob > F      =  0.0103
    Residual |  3961195.3    293  13519.4379           R-squared     =  0.0795
-------------+------------------------------           Adj R-squared =  0.0449
       Total | 4303225.74    304  14155.3478           Root MSE      =  116.27


------------------------------------------------------------------------------
         dg4 |     Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     maranao |  59.68627   32.56299     1.83   0.068    -4.400725    123.7733
 maguindanao |  105.5914   36.57057     2.89   0.004     33.61709    177.5657
      tausog |  5.833333   35.73284     0.16   0.870    -64.49223     76.1589
 balik_islam | -.7843137   41.18928    -0.02   0.985    -81.84867    80.28004
other_muslim |  30.83333   50.90408     0.61   0.545    -69.35066    131.0173
     tagalog |  29.67949   34.07763     0.87   0.385    -37.38848    96.74745
      bisaya |   62.5641   44.05965     1.42   0.157     -24.1494    149.2776
     cebuano |  57.61905   43.20845     1.33   0.183    -27.41922    142.6573
     ilocano |  19.58333   45.03238     0.43   0.664    -69.04461    108.2113
     ilonggo |  33.33333    47.4683     0.70   0.483    -60.08872    126.7554
 other_chri~n |       -30   45.03238    -0.67   0.506    -118.6279    58.62794
        _cons |  106.6667   30.02159     3.55   0.000     47.58137     165.752
------------------------------------------------------------------------------
```

VCM

- Groups of 4 randomly selected within session
- Endowment: PhP300
- Choices:
  - Keep 0, send 300
  - Keep 100, send 200
  - Keep 200, send 100
  - Keep 300, send 0

VCM by religion

Graphs by religion

VCM by ethnicity

Graphs by eth2
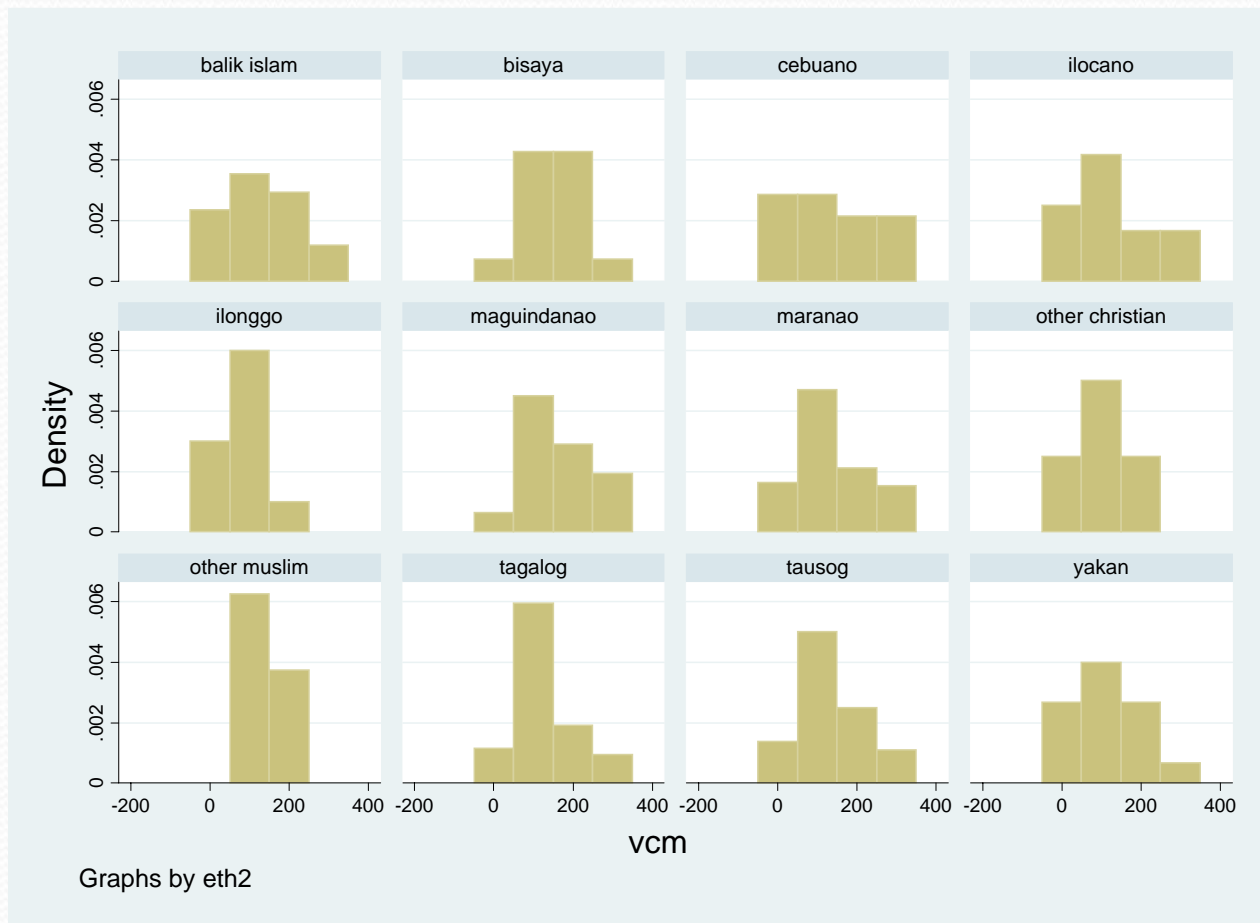
Preliminary Analysis (VCM)

- `. reg vcm muslim`

```
      Source |       SS       df       MS              Number of obs =     306
-------------+------------------------------           F(  1,   304) =    1.62
       Model |  12643.2426      1  12643.2426          Prob > F      =  0.2042
    Residual |  2373500.55    304  7807.56759          R-squared     =  0.0053
-------------+------------------------------           Adj R-squared =  0.0020
       Total |  2386143.79    305  7823.42227          Root MSE      =   88.36


-----------------------------------------------------------------------------
         vcm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+---------------------------------------------------------------
      muslim |   13.29496   10.44758     1.27   0.204    -7.263765    33.85368
       _cons |   123.6842   8.275714    14.95   0.000     107.3993    139.9691
-----------------------------------------------------------------------------
```

Preliminary Analysis (VCM)

```
. reg vcm maranao maguindanao tausog balik_islam other_muslim tagalog bisaya cebuano ilocano ilonggo
other_christian

      Source |       SS       df       MS              Number of obs =     306
-------------+------------------------------           F( 11,   294) =    0.92
       Model | 79149.7563     11  7195.43239           Prob > F      = 0.5242
    Residual | 2306994.03    294  7846.91848           R-squared     = 0.0332
-------------+------------------------------           Adj R-squared = -0.0030
       Total | 2386143.79    305  7823.42227           Root MSE      = 88.583


-----------------------------------------------------------------------------
         vcm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+---------------------------------------------------------------
     maranao |   21.96078   24.80816     0.89   0.377     -26.8633    70.78486
 maguindanao |   47.95699   27.86134     1.72   0.086    -6.875959    102.7899
      tausog |         20   27.22311     0.73   0.463    -33.57687    73.57687
 balik_islam |   16.07843   31.38011     0.51   0.609    -45.67969    77.83655
other_muslim |   24.16667   38.78134     0.62   0.534    -52.15757    100.4909
     tagalog |   13.58974   25.96209     0.52   0.601    -37.50536    64.68484
      bisaya |   36.66667   32.91842     1.11   0.266    -28.11894    101.4523
     cebuano |   22.38095   32.91842     0.68   0.497    -42.40465    87.16656
     ilocano |   11.66667   34.30798     0.34   0.734     -55.8537    79.18703
     ilonggo |  -33.33333   36.16379    -0.92   0.357     -104.506    37.83938
other_chri~n |  -13.33333   34.30798    -0.39   0.698     -80.8537    54.18703
       _cons |   113.3333   22.87199     4.96   0.000     68.31976    158.3469
-----------------------------------------------------------------------------
```

Trust

A → Matatanggap ni A P300 / Matatanggap ni B P300

B → Matatanggap ni A P100 / Matatanggap ni B P 900

Matatanggap ni A P600 / Matatanggap ni B P400

Four Decisions:
1 Religion In-Group
2 Religion Out-Group
3 Ethnicity In-Group
4 Ethnicity Out-Group

Trust: Muslim
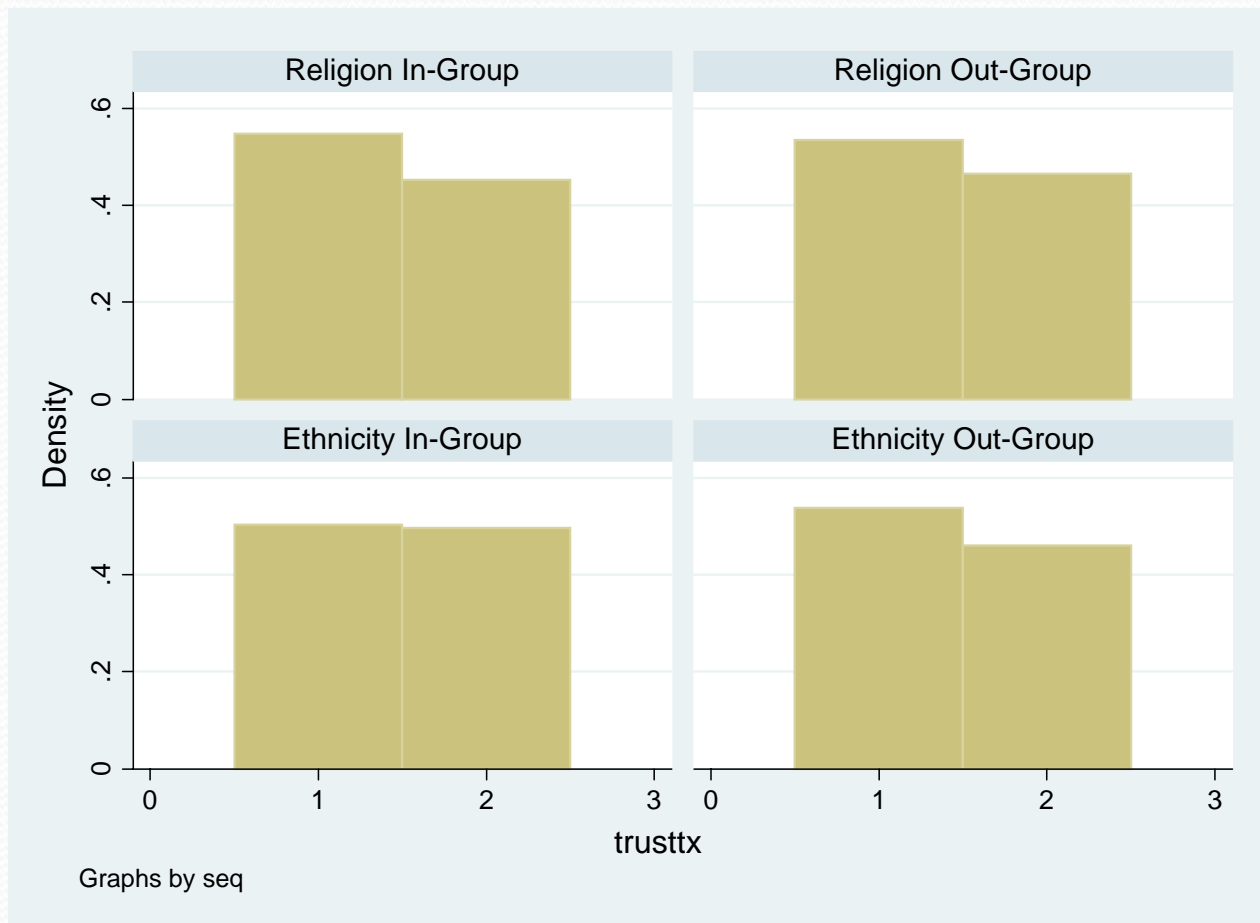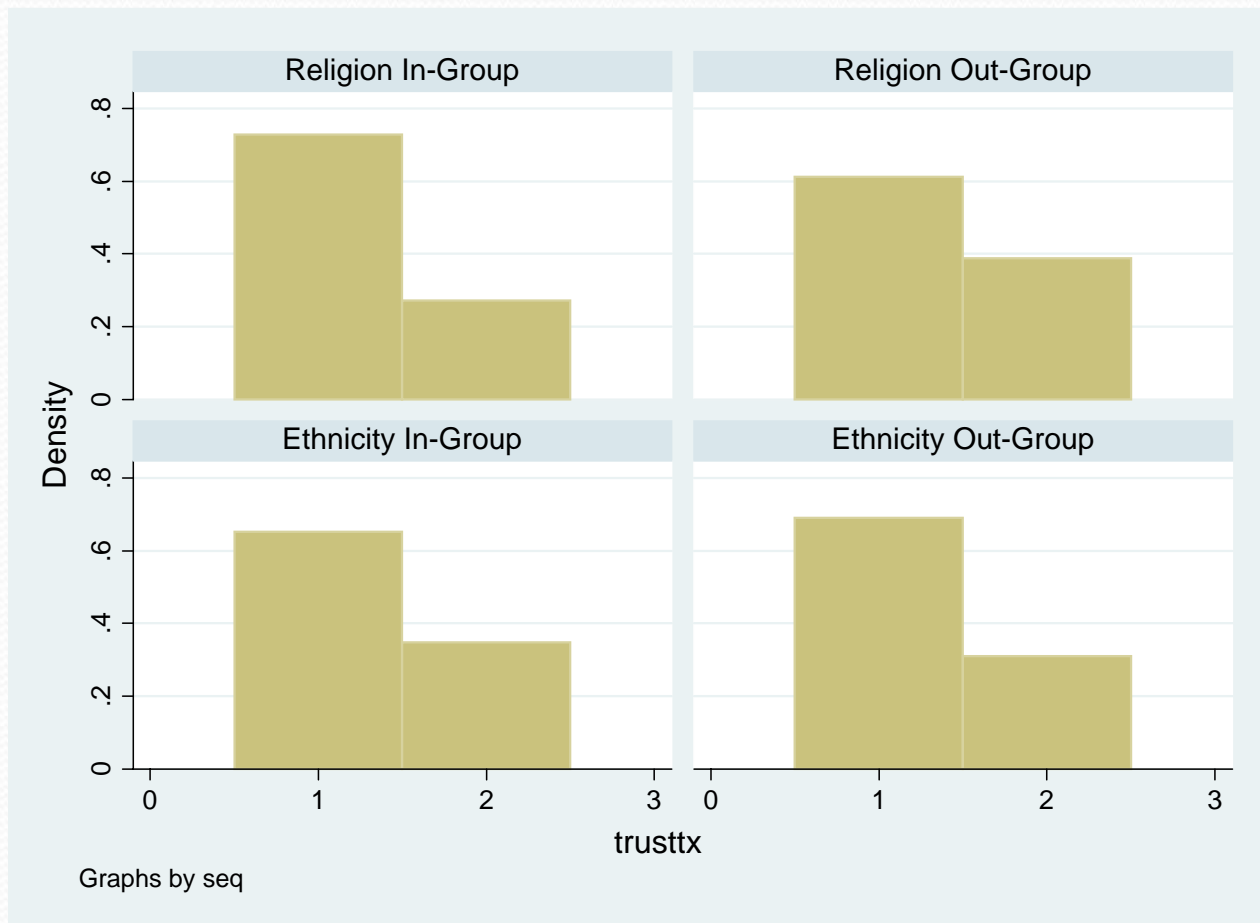
Graphs by seq

Trust: Christian

Trust: Maranao
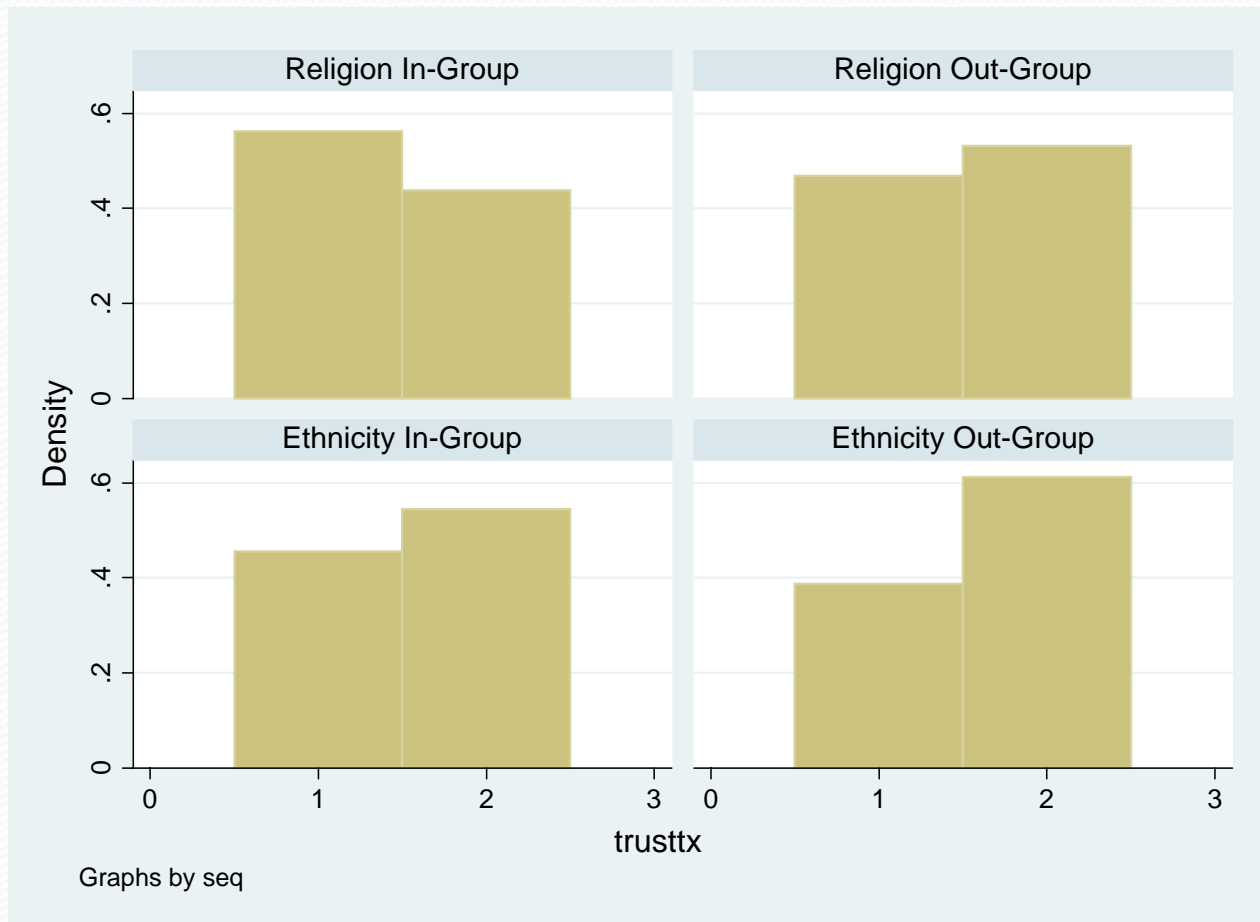
Graphs by seq

Trust Maguindanao

Graphs by seq

Trust: Tausog

Graphs by seq

Trust: Yakan

Graphs by seq

Trust 1

Graphs by religion

Trust 2

Graphs by religion

Trust 3

Graphs by religion
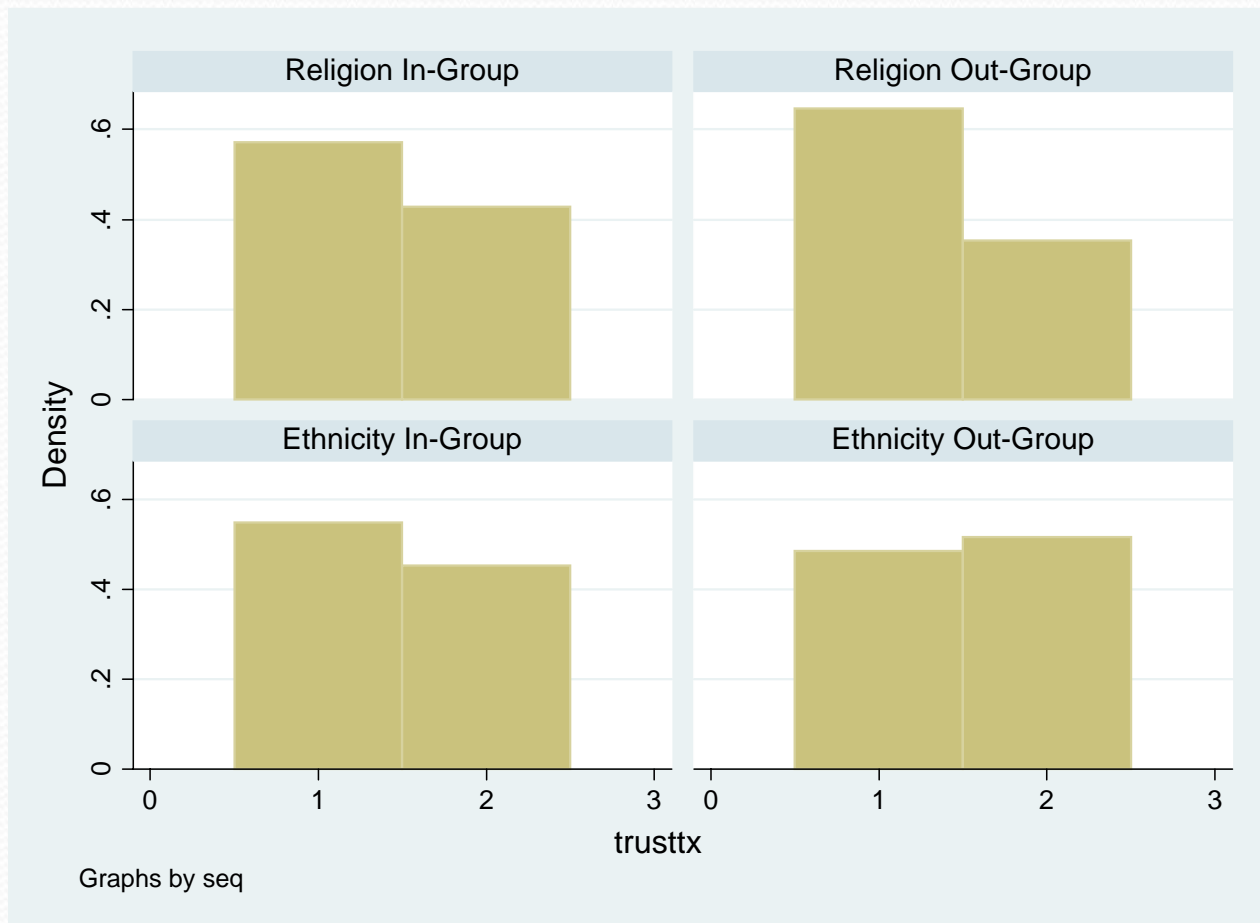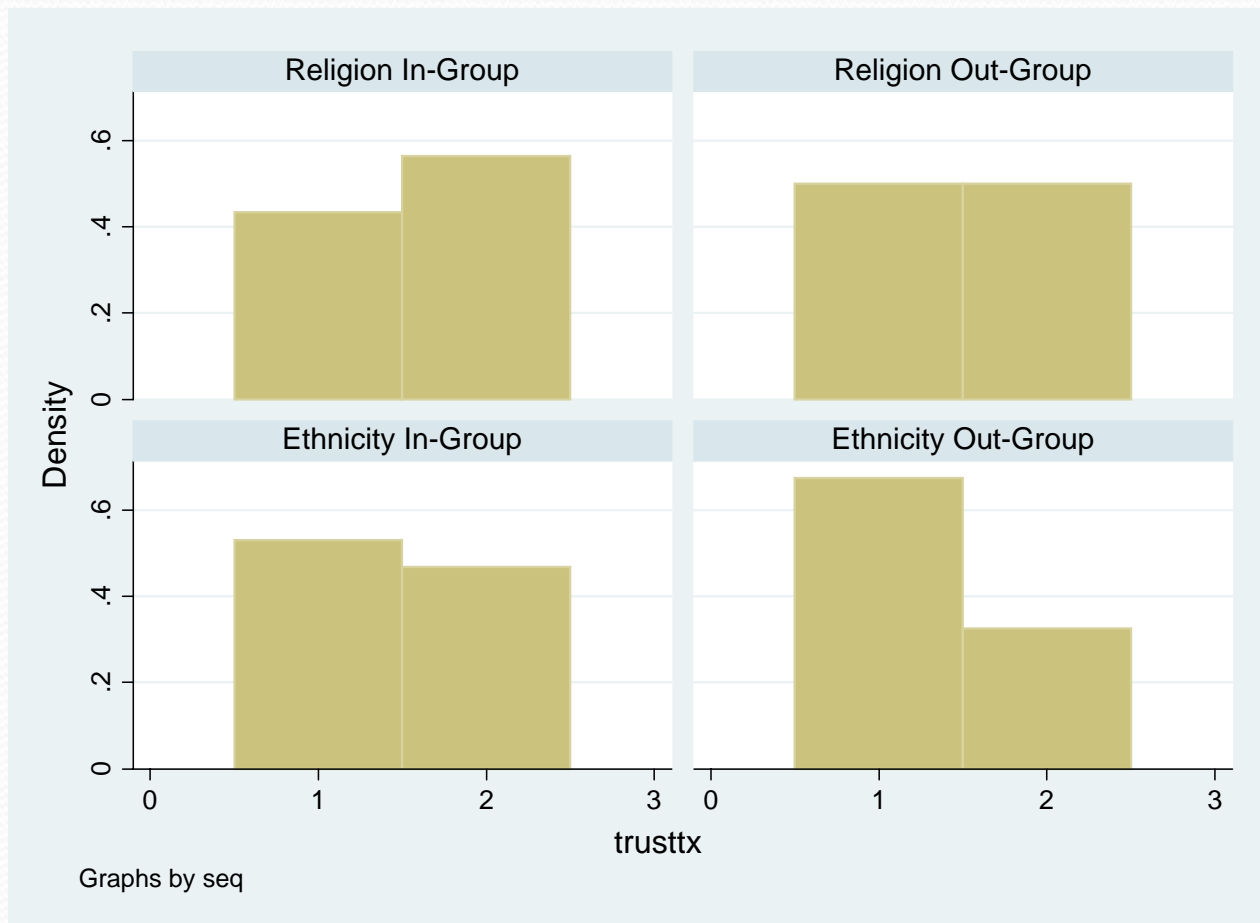
Trust 4
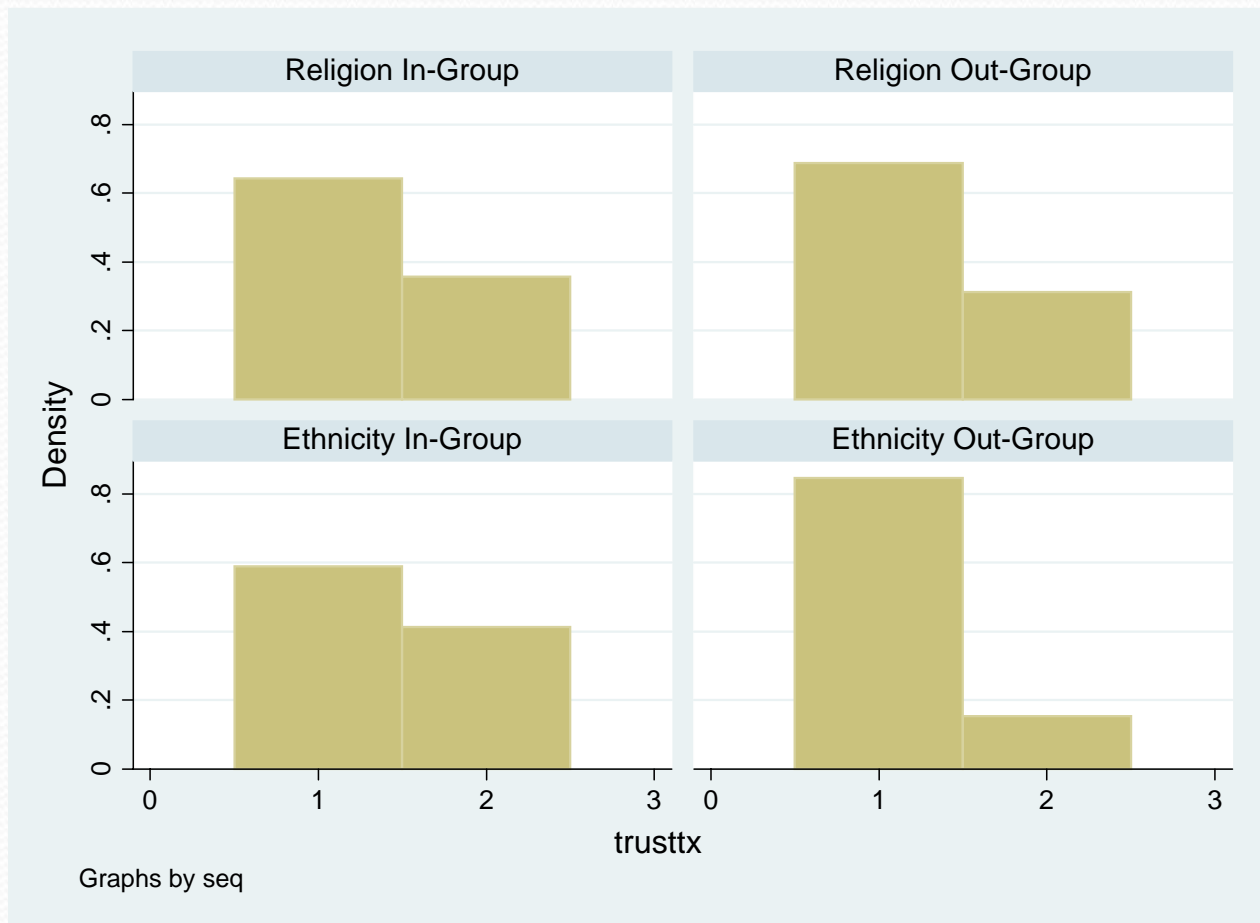
Graphs by religion
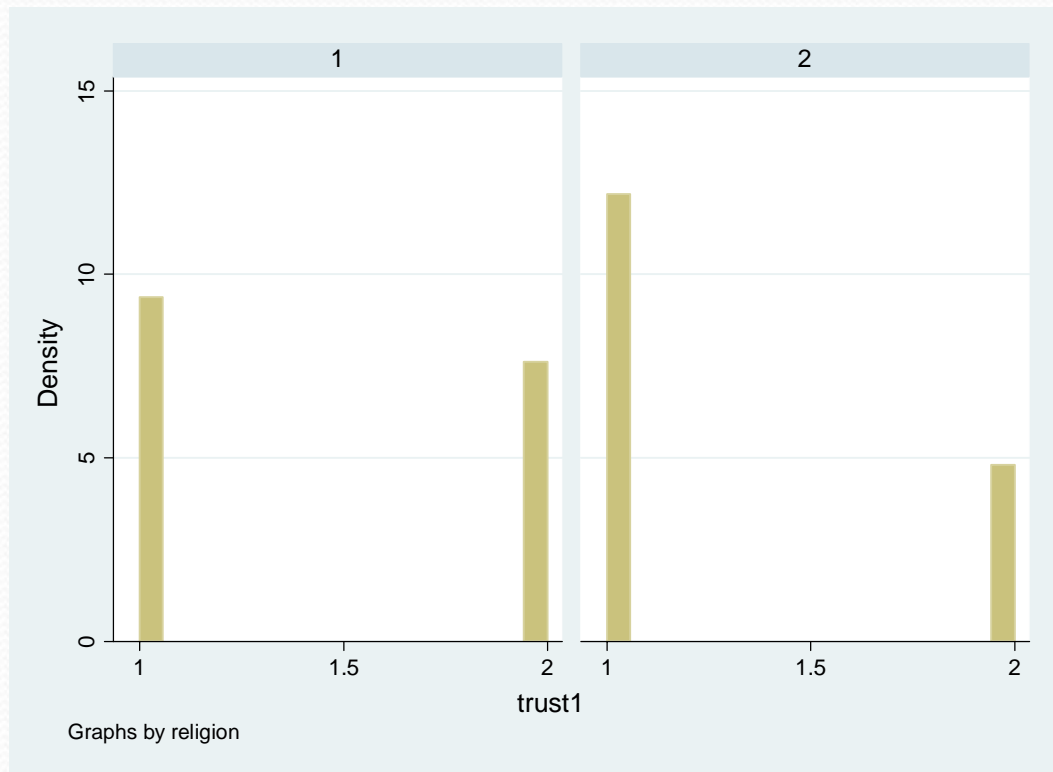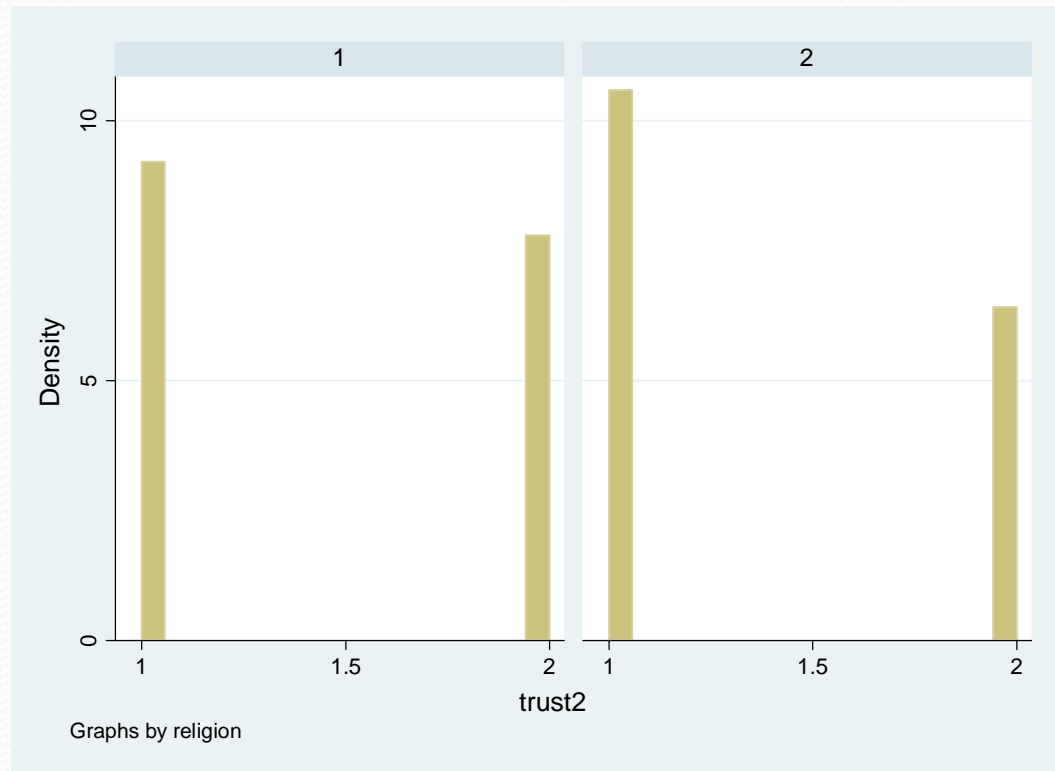
Trust 1
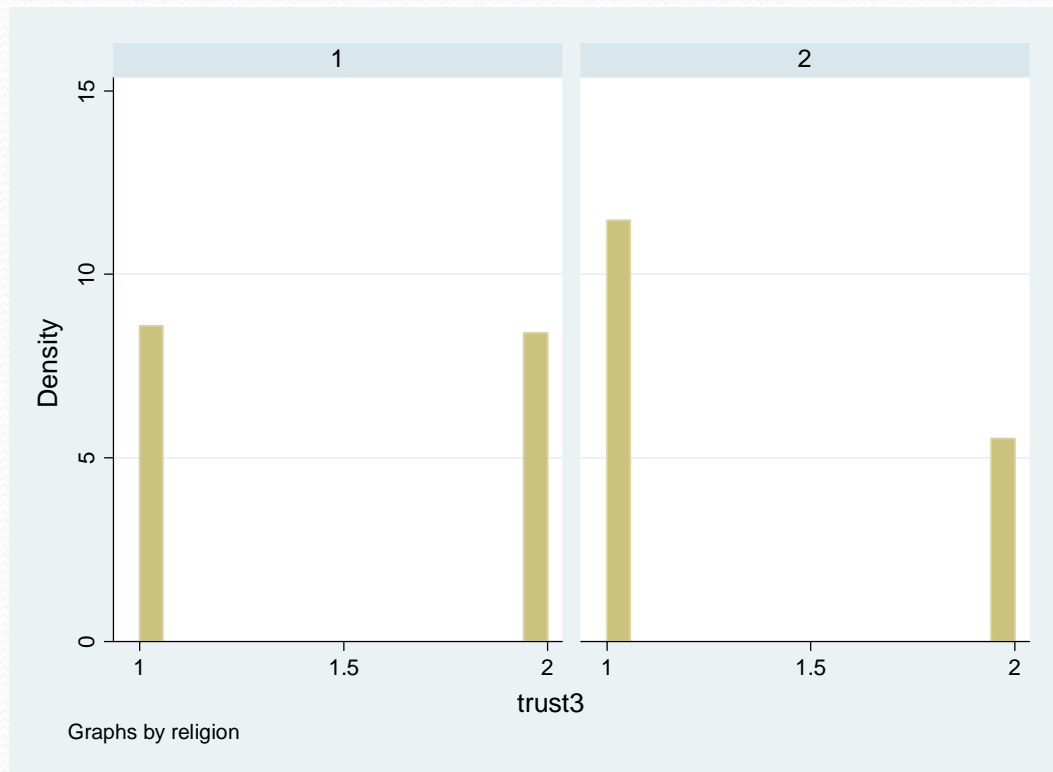
Graphs by eth2
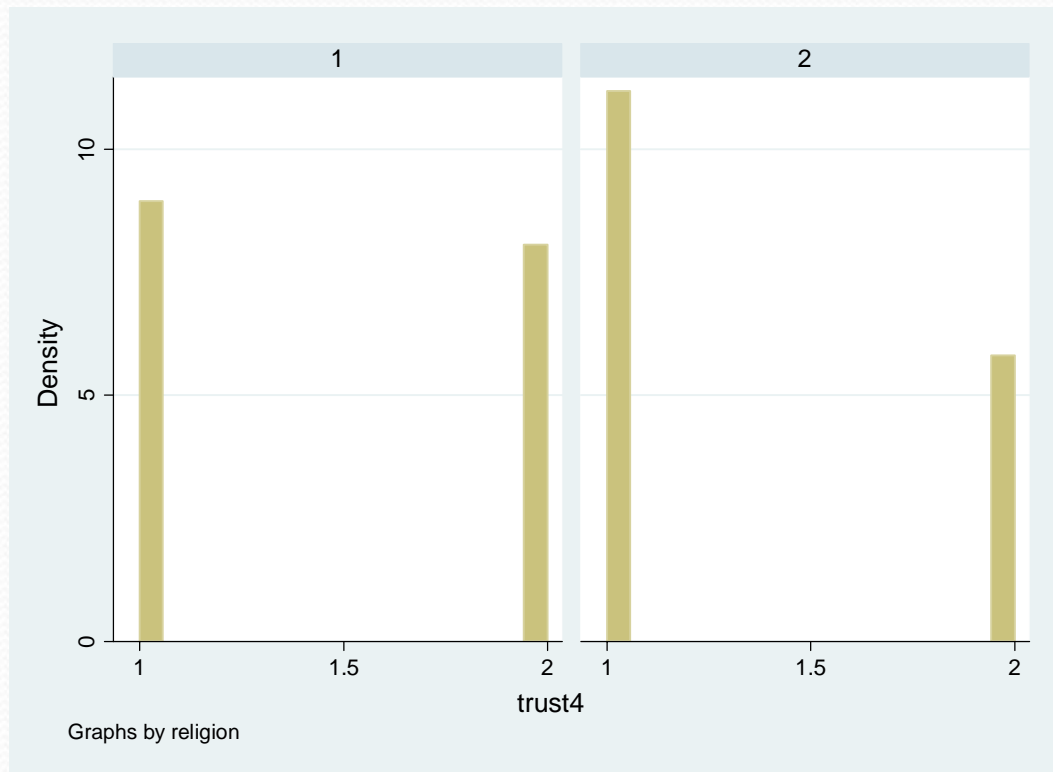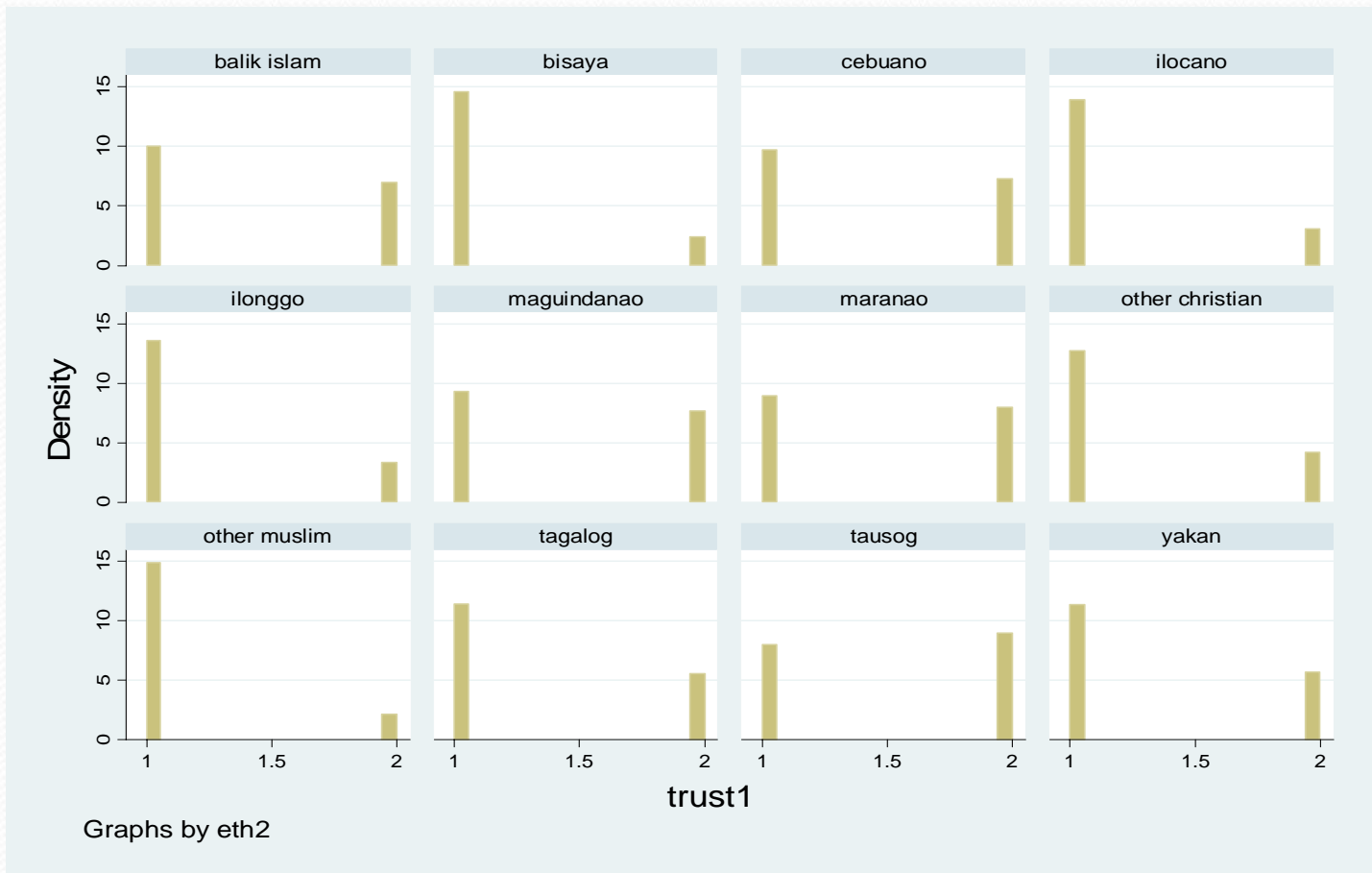
Trust 2
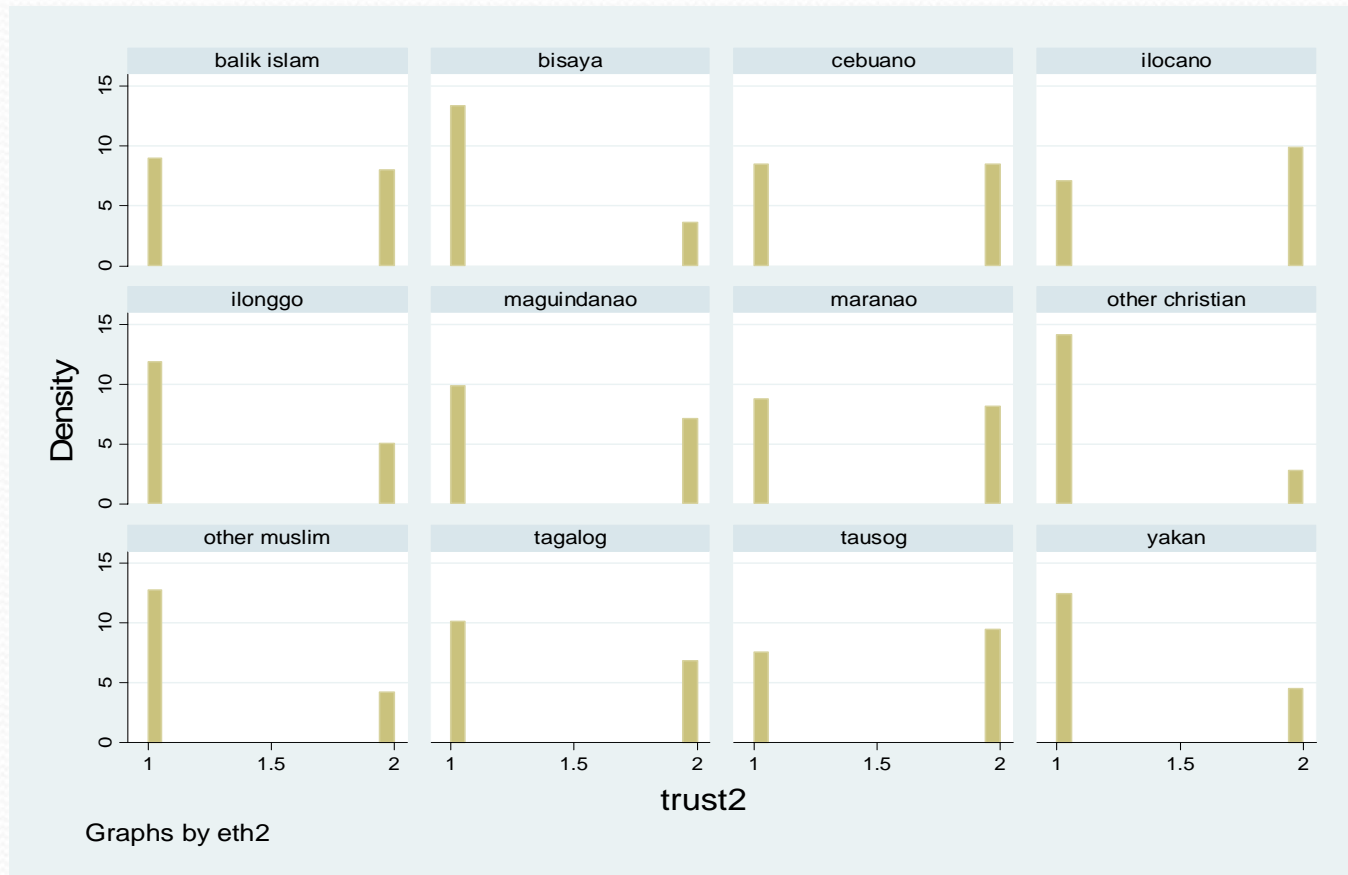
Graphs by eth2
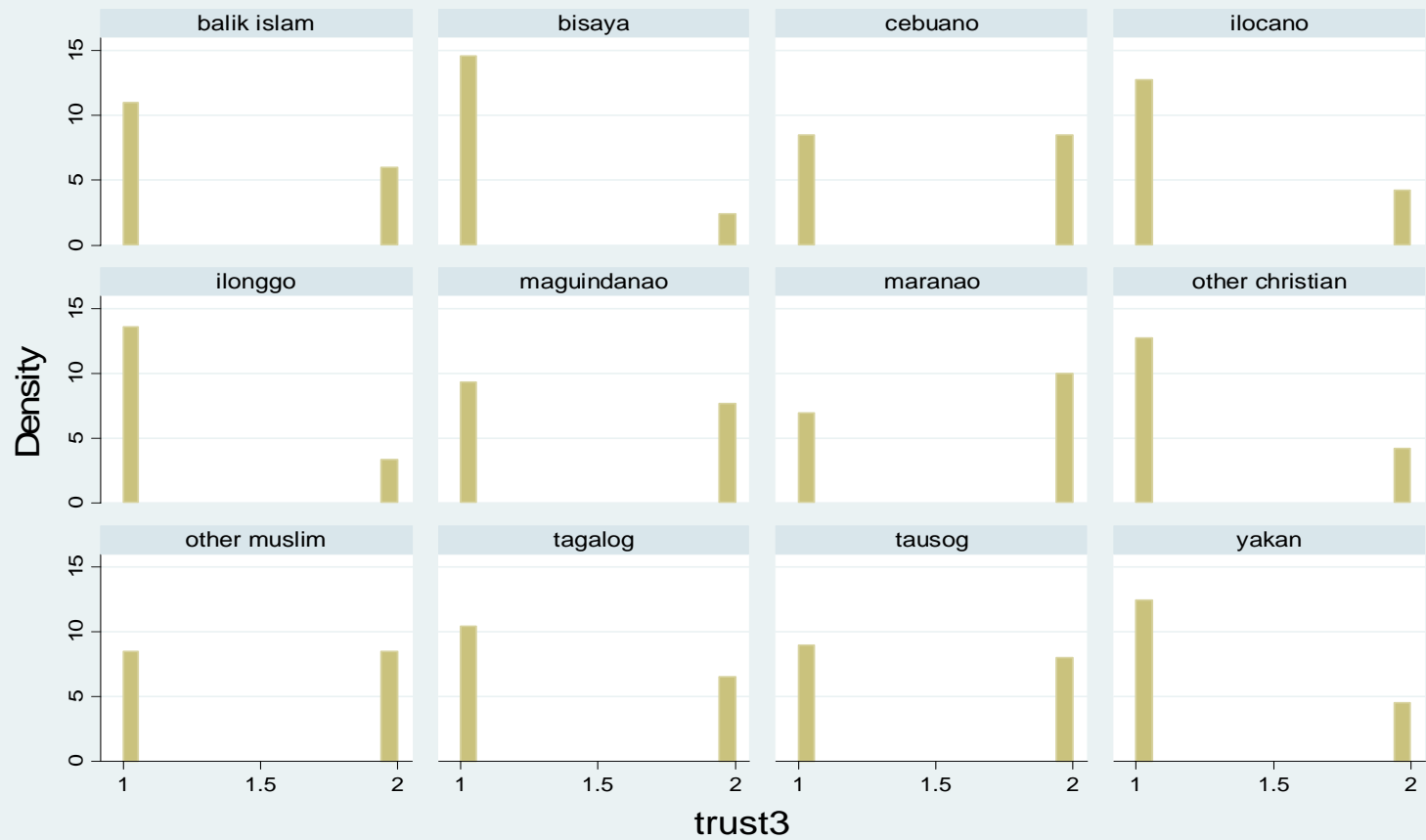
Trust 3

Graphs by eth2

Trust 4
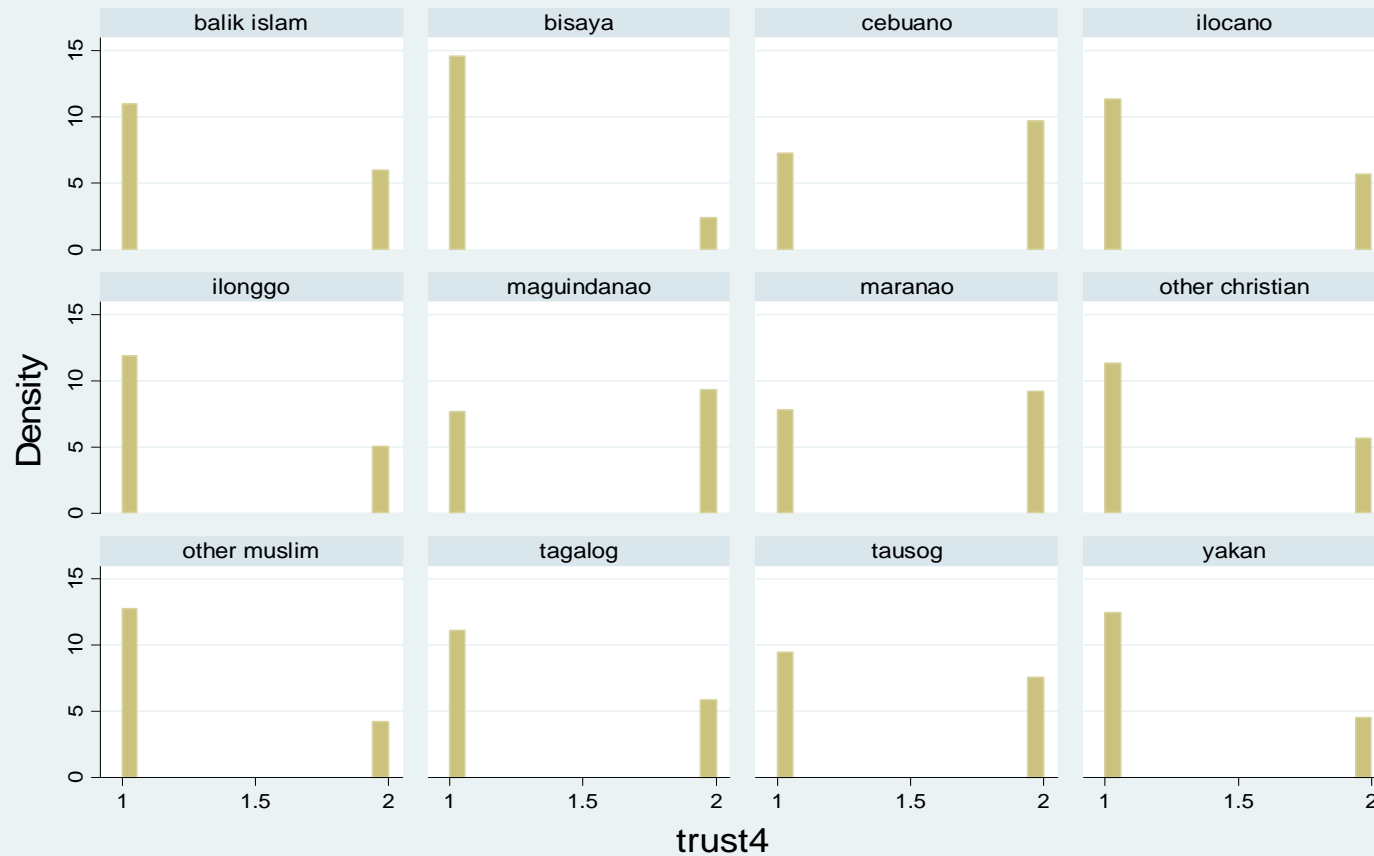
Graphs by eth2

Hypotheses to tests

- Religion dimension
  - Does Muslim and Christians differ in their:
    - Risk attitudes
    - Time discounting
    - Contribution to public goods
  - In-Group and Out-Group differences
    - Do people discriminate between in-group and out-group members?
  - Which matters more—one's religion or the religion of the person one is matched with?

Hypotheses to test (2)

- Ethno-linguistic differences within religions
  - Is in-group ethnic discrimination more pronounced within the Muslim community than the Christian community?
- What characteristics are more important in determining behavior?
  - Ascriptive characteristics determine behavior (religion, ethnicity),
    - in-group preference
    - Ethno-linguistic is more important than religion
  - Modernization—edward shils
    - Higher SES– no discrimination, individualistic behavior
    - 2005 European Sociological Review
  - Panethnolinguistic characteristics
    - The longer they are in Manila the more they view the differences as Muslim vs. Christian than inter-ethnic

Tournament Games with Externalities
(Draft)[*]

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Abstract

We study the formation of coalitions in tournament games. In a tournament game, every agent is endowed with a level of power (e.g. political or military). Agents form coalitions to compete for a prize. The coalition that forms with the largest power distributes the resources across its members. Such games have important applications, for instance in political contests or military wars.

The main concern is to construct equilibrium notions that accurately predict which coalitions are going to form when agents are endowed with certain power and also have externalities toward other agents. These problems often occur in political contests, where parties tend to form coalitions with other parties of similar ideologies rather than forming the grand coalition. Alternatively, externalities might be interpreted as altruism generated by cultural characteristics such as race, language, religion or ancestral homeland (e.g. when there is homophily).

This project introduces new models of coalition formation where agents are endowed with power and have externalities toward other agents. It investigates equilibrium notions that are stable to coalition maneuvers by the agents in the spirit of the core. In particular it characterizes the class of tournaments that are immune to merging and splitting.

1   Introduction

Coalition formation is of fundamental importance in a wide variety of social, political and economical problems, ranging from legislative voting to terrorist alliances. Therefore, there is much about the formation of coalitions that deserves study. For instance, consider a society in which each individual possesses some amount of military power and can form a coalition with other individuals to fight against the remaining individuals. A group (coalition) that forms and has sufficient power becomes the *winning coalition* and split the resources of the society across its members. We assume that a group with more power can eliminate a group with less power. The ultimate goal is to understand the type of winning coalitions that are expect to form, their stability and multiplicity.

The cooperative game theory literature has partially dealt with the problem, especially when the agents only care about their final allocation of the resource (the case without externalities). Nevertheless, this assumption is not realistic in many scenarios. For instance, imagine several groups in an election competing for a resource. Every group is endowed with power and ascriptive attributes such as religion, race, language or ancestral home. Groups are going to form coalitions and the coalition with the greatest power is going to gain all of the resource. A Jewish group may have a negative externality on the resources that a Muslim group receives. On the other hand, two groups composed of similar races might benefit from the resources of each other. The goal of this project is to understand how the coalitions form when such externalities are present. The seminal book [28], pp 219, points out the importance of this problem: "By far the most important consideration emerges once we consider externalities across coalitions..." A particular case of this analysis is when there is homophily ([9] [24] [10] [11]), that is when agents prefer to associate with others who have similar characteristics such as age, race, gender or religion.

This project focuses on two characteristics of the agents that play a key role when forming coalitions: their *power* and their *altruism* toward other agents. These two characteristics have been analyzed separately in the literature, but not together. This project constructs a model that contains these two characteristics.

The power of an agent includes economic, political, cultural or military power. For simplicity, the power is regarded as a single variable, but future extensions of the project focus on the multidimensional case.

The novel assumption of this project is to incorporate altruism toward other agents in the utility function of the agents. Altruism might represent cultural altruism, encompassing similar characteristics like race, language, religion, ancestral homeland, etc. Alternatively, altruism might be interpreted as an externality that agents impose on each other. It might be positive or negative, so agents can profit or lose from the formation of coalitions with other agents.

Equilibriums that are stable to deviations of group of agents are called core-like equilibriums. The current literature in coalition formation has converged to core-like equilibriums as first-best predictions (see above). Unfortunately, even in the simple case of cooperative games without externalities, the traditional results (starting from the Bondareva-Shapley theorem) give very restrictive conditions on the class of games with a non-empty core. Therefore, it is not surprising that generally the conclusions of the literature described above are very negative. The project intends to find relaxations of the core that predict which coalitions are going to form even when the core is non-empty, therefore improving upon this literature.

1.1   Related Literature

A recent literature in coalition formation has been focused mainly on the purely hedonic aspect, when the payoff to a player depends only on the composition of members of the coalition to which she belongs ([7] [3] [31]). Another related strand of work, coming from the cooperative game theory point of view, is [8] [6] [19]. [8] provides conditions under which the core is non-empty.

[19] argues that the grand coalition may not form in the presence of externalities even when it is efficient to do so. The literature in coalition formation has converged to core-like concepts as first-best stability notions on how coalitions are going to form. Unfortunately, even in the simple case of cooperative games without externalities, the classic Bondareva-Shapley theorem gives very restrictive conditions on the class of games with a non-empty core. Therefore, it is not surprising that generally the conclusions of the literature on hedonic coalition formation and cooperative games with externalities are very negative, even in the case of additive preferences ([31]).

[2] [27] and [33] model economic environments with externalities and show that certain bargaining procedures might result in the formation of finer partitions than the grand coalition. [2] assumes that the division of coalitional surplus is exogenously fixed: the game only determines the coalitional structures. He shows that any core stable allocation can be attained as a stationary perfect equilibrium of the game. [27] consider a game in which the proposers offer a coalition and a contingent payoff division. They prove that there exists a stationary equilibrium of their game and provide an algorithm to determine an equilibrium partition. [33] characterizes and compares stable coalition structures under some different rules of coalition formation. None of these papers models externalities directly included in the utility function of the agents as the one presented in this project.

A particular case of this analysis is when there is homophily ([9] [24] [10] [11]), that is when agents prefer to associate with others who have similar characteristics such as age, race, gender or religion. While this is true in certain scenarios, it might also be the case that agents prefer to associate with other of opposite cultures to create complementarities. The model proposed by this project includes homophily as a particular case.

[1] studies political economies where agents are endowed with power. Specifically, they provide an axiomatic approach that determines a unique stability concept and a dynamic game that implements that stability concept. However, all of their analysis is externality-free.

1.1.1 Coalition formation and the CCPV project

The study of coalition formation has a cross-disciplinary nature, especially deriving interest from sociologists, computer scientists and economists. The models of coalition formation have multiple potential applications, including the stability of economic and political unions, or the formation of alliances across different cultural groups. In particular, part of the analysis in this project (especially the part in coalition formation) was proposed by the PI and partially used in the multidisciplinary AFOSR project **Coherence Based Modeling of Cultural Change and Political Violence**. This analysis is crucial to understand the effects of different policies on configurations of culture (ideologies, values, and beliefs).

The simulation team of the CCPV project is a dynamic program composed of three steps: (1) Coalition formation, (2) Coalition Interaction and state of world Outcomes, and (3) the Coherence and Attitude Change Modeling.

Part 1, on coalition formation, simulates how different agents with different cultural characteristic (e.g. language, religion) would form coalitions when competing for a resource. The social planer inputs the matrix of externalities based on experiments and other observable variables, and the software outputs the formation of coalition using a tournament game and one of stability notions selected (e.g. CORE or MPSP) described in section 2 below.

Part 2, using the partition of the society in step 1, calculates whether each coalition will choose to engage in conflict, and to what level of resources will be devoted to this conflict. Thus the power obtained in part 1 might change hands depending on whether or not the coalitions engaged in conflict, and depending on the winner of the war.

Finally, part 3, the coherence and attitude change models how changes in preferences and beliefs occur (using the seminal coherence model [4]). In a simple reduced model like the one

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proposed by this project, it models how preferences over other agents change. The goal of this project is to improve the accuracy of part 1, coalition formation. The technical details in the modeling of formation of coalitions is discussed in the following section.
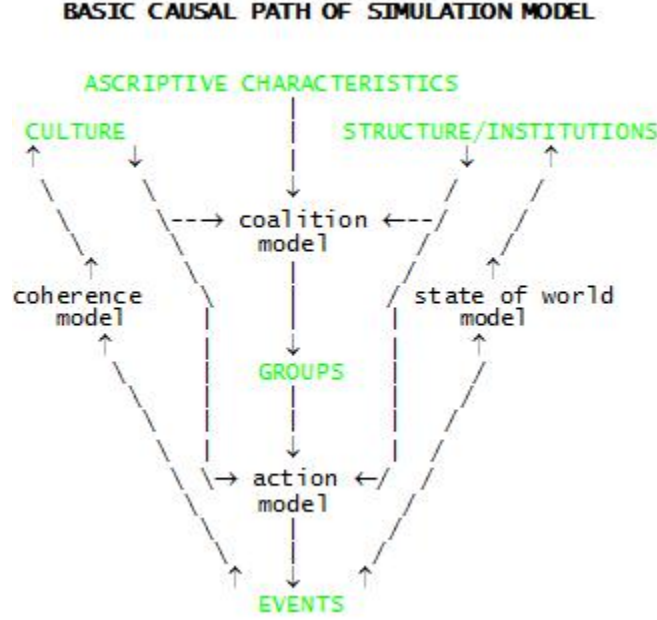
Figure 1: Flow of the simulation model in the CCPV project.

2   The model

Let Y be a divisible resource, say money. Let N be a set of agents $N = \{1, 2, ..., n\}$, and each agent has an additive preference on his share of money and other agents' shares. Each agent has a power described as $\pi_1, \pi_2, ..., \pi_n$ with $\pi_i \geq 0$ and $\sum_{i=1}^{n} \pi_i = 1$. Also, without loss of generality, we assume that $\sum_{i \in S} \pi_i \neq \sum_{j \in T} \pi_j$ for all $S \neq T$, so we do not have any ties.

A *partition* is a collection of disjoint subsets $S_1, S_2, .., S_k$ of N where $\bigcup_{i=1}^{k} S_i = N$. Each subset S_j in the partition is called a *coalition*. The power of a coalition S is given by $\pi(S) = \sum_{i \in S} \pi_i$. The winning coalition for a partition $\Pi = (S_1, ..., S_k)$ is the subset S_j with $\pi(S_j)$ maximum.

In a tournament, agents form coalitions in order to win the game, or more generally, in order to increase their net utilities (see below).

Let ξ be a function that specifies the allocations of the resource across the winning agents. That is, for any agent $i \in S \subseteq N$, $\xi_i(S)$ is the allocation of the money to agent i with $\sum_{i=1}^{n} \xi_i(S) = Y$ when coalition S is winning. We assume that ξ is *cross-monotonic* on the size of the coalition, that is $\xi_i(S) > \xi_i(T)$ for $i \in S \subset T$.

We are going to consider by far the two rules for dividing money to agents in the winning coalition, which are equal-sharing and proportional sharing. Further extensions consider convex combinations of them, and additional variations.

Let S be the winning coalition.

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1. Equal sharing is given by

$$\xi_i(S) = \begin{cases} \dfrac{Y}{|S|} & \text{if } i \in S, \\ 0 & \text{otherwise.} \end{cases}$$

   So under equal sharing, all agents in the winning coalitions share the same amount of the resource.

2. Proportional sharing is given by

$$\xi_i(S) = \begin{cases} \dfrac{\pi_i}{\pi(S)}Y & \text{if } i \in S, \\ 0 & \text{otherwise.} \end{cases}$$

   where $\pi(S) = \sum_{j \in S} \pi_j$ for notational convenience. So under proportional sharing, each agent's share depends on his power and the total power in the winning coalition.

Definition 1 Externality *is a situation in which each agent cares not only about himself, but also possibly cares about the other agents. Those relationships are represented by an $n \times n$ matrix for n agents, with entries M_{ij} representing the externality that agent j imposes on agent i. The* payoff function *is a vector $U = Mx$ defined by $U_i(x_1, x_2, ..., x_n) = (Mx)_i = \sum_j M_{ij}x_j$. When there are no externalities, M is the identity matrix.*

Definition 2 *For a partition Π, the* net utility *to agent i is $v_i(\Pi) = \sum_{j \in S^*} M_{ij}\xi_j(S^*)$ where S^* is the coalition in Π with the largest power. The object of the game is to maximize your net utility. That is, agent i tries to find the partition that maximizes $v_i(\Pi)$. Notice in the case without externalities the agents try to maximize $\xi_i(\Pi)$.*

2.1 Three stability notions

Definition 3 *The* CORE *is the set of all partitions with the property that no subset $S \subseteq N$ can improve their net utilities by forming a coalition. That is, a partition Π is in the core (or Π is core-stable) if there does not exist $S \subseteq N$ such that $v_i(\Pi - S, S) > v_i(\Pi)$ for all $i \in S$. Thus there is no set of agents S that would be all be better off by forming their own coalition. (If $\Pi = (T_1, ..., T_n)$, then $(\Pi - S, S)$ denotes the partition $(T_1 - S, ...T_n - S, S)$.)*

As we will see below, the CORE is very often empty. Therefore there is a need to propose stability notions that relax it. We find below two equilibrium concepts that contains the core and are always non-empty.

The first notion of stability proposed by this project is *merge-proofness (MP)* and *split-proofness (SP)*. We say a coalition structure is merge-proof if no group of coalitions in the partition structure can profit by merging. We say a partition structure is split-proof if there is no subcoalition of an element in the partition that can profit by splitting. MP and SP are not new in the game theory literature, see for instance [20] [12] in rationing problem, [22] [25] in scheduling problems.

MP and SP are simple stability tests that require minimal coordination after coalitions are formed. In particular, they do not require agents to break agreements across coalitions, like in the CORE. That is, whenever a winning coalition S is formed, SP guarantees that no subcoalition from S would also be winning. On the other hand, MP guarantees that the losing coalitions would not profit by merging.

Definition 4 • *A partition Π is* merge-proof (MP) *if there is not a set of coalitions $S_1, \ldots, S_k \in \Pi$ such that they profit by merging. That is $v_i(\Pi \setminus \{S_1, \ldots, S_k\}, \cup_{j=1}^k S_j) > v_i(\Pi)$ for all $i \in \cup_{j=1}^k S_j$.*

- *A partition Π is* split-proof (SP) *if there is no coalition $S \in \Pi$ and subcoalition $T \subset S$ such that $v_i(T, S \setminus T, \Pi \setminus S) > v_i(\Pi)$ for all $i \in T$.*

Fix a coalition structure. Merge-proofness implies that no two coalitions in this structure want to break away and form a new coalition together. Split-proofness implies that for any coalition in the structure, no group of agents want to break away from the coalition. These two concepts are compelling in this problem. Indeed, consider a given coalition structure. Suppose a group of agents are considering to form a new coalition. It is reasonable to think that, the higher the number of agents who are involved in the bargaining process, the costlier the move is to a new coalition. Moreover, these costs may be lower for agents who already are in the same coalition. Therefore, Split-Proofness ensures that those agents for whom it is cheapest to bargain do not have an incentive to break away. For Merge-Proofness, we may argue that only a representative of the coalitions have to be involved in the bargaining process, again making it cheaper for them to negotiate. Again, Merge-Proofness ensures that these representatives/coalitions do not have an incentive to break the current coalition structure.

Notice these two properties are clearly met independently. A coalition that is split-proof is the singletons $\{1, \ldots, n\}$. On the other hand, the grand coalition N is merge-proof. A partition that is simultaneously merge-proof and split-proof would be call a *MPSP* partition. When there is no confusion, MPSP would also be called the set of merge-proof and split-proof equilibria.

Definition 5 *Under the* No-Threat Equilibrium (NTE) *if a group of agents find it profitable deviate from a coalition, then there is another group of agents who can react to that deviation in a way that harms the agents who originally deviated. Thus, Π is NTE (or Π is NTE-stable) if whenever $S \subseteq N$ is such that $v_i(\Pi - S, S) > v_i(\Pi)$ for all $i \in S$, then there exists $T \subseteq N - S$ such that $v_i(\Pi - (S \cup T), T, S) > v_i(\Pi - S, S)$ for all $i \in T$ and $v_i(\Pi - (S \cup T), T, S) < v_i(\Pi)$ for some $i \in S$. This means that at least one member of S will in the long run not profit by deviating to form the coalition S.*

Note that the distinction between the core and NTE is that with a core-stable partition, no group can gain an advantage by forming a new coalition. With an NTE-stable partition, it may be possible for a group to deviate and gain a temporary advantage by forming a new coalition - but if they do so, then yet another coalition can react to punish them. NTE is related to the $\beta-$core discussed in the literature of cooperative games, but has not been used before in the literature of coalition formation.

2.2 Stability in tournament without externalities

As suggested by a referee, we provide below the comparison of equilibriums in the case without externalities.

Definition 6
- *A* minimally winning coalition *is a winning coalition $S^* \subseteq N$ satisfying $\pi(S^*) > 1/2 > \pi(S^* - \{j\})$ for all $j \in S^*$.*
- *A* minimally winning coalition of minimal size (MWCMZ) *is a minimally winning coalition $S^* \subseteq N$ satisfying $|S^*| \leq |S|$ for all $S \subseteq N$ with S minimally winning.*
- *The* minimally winning coalition of minimal weight (MWCMW) *is minimally winning coalition $T^* \subseteq N$ such that $\pi(T^*) \leq \pi(T)$ for all $T \subseteq N$ minimally winning.*

Example 7 *Suppose an externality-free environment with five agents and vector of power $\pi = (.41, .34, .12, .10, .8)$.*

This tournament has an empty core. Indeed, it is not difficult to see that no matter what winning coalition forms, there is always another coalition that can block. For instance, if the

coalition {12, 345} *forms, then agents* 12 *are winning and will split the resource between them.* *Nevertheless, this partition is not stable, since agent 1 can block by deviating:* {1, 2, 345}.

Now consider the following partition: {245, 13}. *This partition is not core stable, as* 12 *can form their own partition and share the resource between two agents. Nevertheless, this partition is robust to splitting of coalitions: No group of agents in* {245} *would be better off by splitting: if any group say 24 split 245, then agents 13 will be the winners. Therefore, this partition is robust to splitting. Any CORE deviation would require coordination between two different groups.*

On the other hand, {12, 345} *is a NTE equilibrium, since if agent 1 decides to split to form his own partition* {1, 2, 345}, *then agent 2 can threat agent 1 by merging with 2345 and form partition* {1, 2345}, *under which agent 1 is worse off.*

Theorem 8   *i. Under Equal-Sharing, the CORE is non-empty if and only if the minimally winning coalition of minimal size is in the CORE.*

    ii. Under Proportional-Sharing, the CORE is non-empty if and only if the minimally winning coalition of minimal weight is in the CORE.

Theorem 9 *For any cross-monotonic sharing rule (in particular the proportional or the egalitarian rule), the MPSP is always non-empty. It contains the minimally winning coalition of minimal weight.*

Sketch. Consider the MWCMW S, then clearly $\pi(S) - \pi(N \setminus S)$ is minimum across all minimally winning coalitions. We claim that the partition $(S, N \setminus S)$ is simultaneously merge-proof and split-proof.

Clearly $(S, N \setminus S)$ is merge-proof: the agents in S cannot profit by sharing the surplus with other agents.

Now, we prove by contradiction that $(S, N \setminus S)$ is split-proof.

Indeed, assume that a coalition can profit by splitting. Let $i \in S$ the agent with the smallest weight in S. Then $S \setminus i$ can also profit by splitting. Therefore $\pi(N \setminus S) < \pi(S \setminus i)$.

Consider the partition $((N \setminus S) \cup i, S \setminus i)$. We show that

$$\pi((N \setminus S) \cup i) - \pi(S \setminus i)) < \pi(S) - \pi(N \setminus S).$$

Indeed, this inequality holds if and only if $\pi(N \setminus S) < \pi(S \setminus i)$ which cannot occur because $S \setminus i$ is minimally winning.

Hence $(S, N \setminus S)$ does not minimize $\pi(S) - \pi(N \setminus S)$.

∎

Theorem 10   • *Under Equal-Sharing, the NTE is non-empty and contains the minimally winning coalition of minimal size.*

    • *Under Proportional-Sharing, the NTE is non-empty and contains the minimally winning coalition of minimal weight.*

The contrast between NTE and MPSP is seen under the equal-sharing rule. NTE predicts the minimally winning coalition of minimal size whereas MPSP predicts the minimally winning coalition of minimal weight. Both notions are compelling under different circumstances and should be tested in the lab as suggested below.

	CORE	MPSP	NTE
Proportional	Might not exist	MWMMW	MWCMW
Equal-sharing	Might not exist	MWCMW	MWCMZ

2.3 Existence of equilibria for equal-sharing

From the empirical observations of the CCPV model, different cultural groups have different altruism toward other members. However that altruism is usually small relative to how much they value getting the money for themselves. We provide below a class of conditions on the matrix of externalities that always have a MPSP equilibrium.

Condition A. $M_{ij} < M_{ii}$ for any $i, j \in N$, $i \neq j$.

Condition A states that agents prefer getting the money that giving it to other people. In particular, it rules out some economies like charity where some agents have more satisfaction by giving their money away than by keeping it for themselves.

Let $i(2)$ the most preferred type of agent i but himself, that is $M_{ii(2)} \geq M_{ij}$ for any $j \neq i$

Condition B. $\frac{\sum_{j \neq i(2)} M_{ij}}{n-1} \geq M_{ii(2)}$.

That is, under condition B, the preferred type of agent i should not have an externality larger than the average of the agents but $i(2)$.

In particular, notice that if there are negative externalities, that is $M_{ij} \leq 0$ for all $i \neq j$, and the externality that other people caused on agent i do not exceed their potential benefit, that is: $\sum_{j \neq i} M_{ij} < M_{ii}$, then conditions A and B are satisfied.

Proposition 11 *Assume that the matrix of externalities M satisfies conditions A and B. Then, for any vector of power π there is a MPSP equilibrium.*

Sketch.

We will show that conditions A and B imply that the MWCMW, S^*, is a MPSP equilibrium.

First notice that we can transform preferences that satisfy condition B to a matrix of negative externalities. Indeed:

$$\frac{\sum_{j \neq i(2)} M_{ij}}{n-1} \geq M_{ii(2)} \Leftrightarrow$$

$$M_{ii} - M_{ii(2)} \geq \sum_{j \neq \{i(2), i\}} M_{ii(2)} - M_{ij} \Leftrightarrow$$

$$M_{ii} - M_{ii(2)} \geq \sum_{j \neq \{i\}} M_{ii(2)} - M_{ij} \tag{1}$$

Consider the new matrix of externalities $\tilde{M}$ such that every element ij is replaced as follows:

$$\tilde{M}_{ij} = M_{ij} - M_{ii(2)}.$$

Since under equal sharing, preferences are invariant to addition of a constant, then $\tilde{M}$ generate the same coalition structure as M.

Clearly the matrix $\tilde{M}$ has negative externalities and condition A is satisfied: $\tilde{M}_{ii} \geq \tilde{M}_{ij}$ for all $j \neq i$.

Moreover, by equation 1:

$$\sum_{j \neq i} -\tilde{M}_{ij} \leq \tilde{M}_{ii} \text{ for all } i. \tag{2}$$

Now, we show that preferences are cross monotonic. Indeed, the utility of agent i if $S \subset N \setminus k$ forms is:

$$\frac{\sum_{j \in S} M_{ij}}{|S|} \geq \frac{\sum_{j \in S \cup k} M_{ij}}{|S+1|} \Leftrightarrow$$

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$$\frac{\sum_{j \in S} M_{ij}}{|S|} \geq M_{ik}. \tag{3}$$

Since $\frac{\sum_{j \in S} M_{ij}}{|S|} > 0$ (by equation 2) and $M_{ik} \leq 0$ then equation 3 holds.

Cross-monotonicity implies that $(S^*, N \setminus S^*)$ is merge-proof, where S^* is the MWCMW.

We now show that $(S^*, N \setminus S^*)$ is split-proof. By equation 2, the new utility of the agents in S^* at $(S^*, N \setminus S^*)$ is nonnegative. Using a similar argument provided in the sketch of theorem 9, if a coalition T from S^* splits, then it will be losing and evaluate his utility in $N \setminus S^*$, which is negative by equation 2. Hence S^* is split-proof.

∎

It is not difficult to show that is a matrix generates a cross-monotonic set of payments, then $M_{ij} < \sum_{k \in S} \frac{M_{ik}}{|S|}$ for all $i \in S$ and $j \in N \setminus S$. We show below that whenever this condition occurs, there exist a MPSP equilibrium. Nevertheless, the coalition that it implements might not be the MWCMW. The proof is based on an algorithm and is not provided by space reasons.

On the other hand, cross-monotonicity is required for implementation of the MWCMW. We can prove that if the matrix of externalities M does not generate cross-monotonic payments, then MWCMW cannot be implemented as a MPSP equilibria (either because the MPSP is empty, or because it is not MPSP).

Theorem 12
- *Assume the matrix of externalities M generates a cross-monotonic allocation, that is such that $M_{ij} < \sum_{k \in S} \frac{M_{ik}}{|S|}$ for all $i \in S$ and $j \in N \setminus S$. Then, under equal-sharing, MPSP is non-empty for any vector of powers π.*

- *For any matrix $\tilde{M}$ that does not generate a cross-monotonic allocation, that is such that $\tilde{M}_{ij} > \sum_{k \in S} \frac{\tilde{M}_{ik}}{|S|}$ for some i, j. Then, there exists a vector $\tilde{\pi}$ such that $(\tilde{\pi}, \tilde{M})$ such that the MWCMW is not a MPSP partition.*

Under the proportional rule, the matrix of externalities generates a cross-monotonic set of payments if $m_{ij} < \sum_{k \in S} \frac{m_{ik}}{|\pi(S)|}$ for all $i \in S \subseteq N$ and $j \notin S$. Nevertheless, it is not clear what additional condition is necessary to guarantee the existence of a MPSP partition.

3   Further extensions

The model discussed above brings good news to the formation of coalitions. MPSP and NTE are feasible for a fairly large class of tournament games. In the case of MP and SP, the main question is whether we can extend the above results to the case to alternative cross-monotonic payment functions like the convex combination of equal sharing or proportional.

On the other hand, there is a need to characterize a compelling class of tournaments that have a non-empty NTE, like the one provided in Theorem 12 for MPSP.

The most challenging question is to come up with other meaningful notions of stability that predict outcomes under different scenarios. Further work of the author tries to generalize the above class of formation games, for instance by incorporating a broader class of preferences and some dynamic aspects.

Experiments can also help on testing whether the coalition equilibriums approximate reality. In particular, we conjecture that MPSP equilibrium is a good predictor when agents have little time to communicate. On the other hand, a NTE type is probably a better predictor when agents have longer time to communicate.

References

[1] D. Acemoglu, G. Egorov, K. Sonin, 2006. Coalition Formation in Political Games. Mimeo CEFIR/NES Working Paper.

[2] F. Bloch, 1996. Sequential formation of coalitions in games with externalities and fixed payoff division. Games Econ. Behav. 14, 90123.

[3] A. Bogomolnaia and M. Jackson, 2000. The Stability of Hedonic Coalition Structures, Games and Economic Behavior.

[4] S. Chai, 2001. Choosing an identity: a general model of preference and belief formation. University of Michigan Press.

[5] C. Chambers, 2007. An Ordinal Characterization of the Linear Opinion Pool. Economic Theory 33, 457-474.

[6] G. de Clippel and R. Serrano, 2006. Marginal contributions and externalities in the value. Forthcoming Econometrica.

[7] J. Dreze and J. Greenberg, 1980. Hedonic Coalitions: Optimality and Stability, Econometrica 48, 987-1003.

[8] I. Hafalir, 2007. Efficiency in coalition games with externalities. Games and Economic Behavior 61 242-258.

[9] M. Jackson, S. Currarini and P. Pin, 2009. An Economic Model of Friendship: Homophily, Minorities and Segregation. Econometrica 77(4) 10031045.

[10] M. Jackson, 2008. Average Distance, Diameter, and Clustering in Social Networks with Homophily. Proceedings of the Workshop in Internet and Network Economics (WINE).

[11] M. Jackson and B. Golub, 2009. How Homophily affects Diffusion and Learning in Networks. Mimeo Stanford University.

[12] B. Ju, 2003. Manipulation via merging and splitting in claims problems. Review of Economic Design 8(2) 1434-4742.

[13] R. Juarez, 2008. Optimal Group strategyproof cost sharing: budget balance vs budget surplus. Revised Economic Theory.

[14] R. Juarez, 2008. Group strategyproof cost sharing: the role of indifferences. Mimeo University of Hawaii. Revised and resubmitted, Games and Economic Behavior.

[15] R. Juarez, 2008. The worst absolute surplus loss in the problem of commons: Random Priority vs. Average Cost. Economic Theory 34.

[16] R. Juarez, 2009. Collusion-Proof Cost Sharing. Under Review Journal of Economic Theory.

[17] R. Juarez, 2009. Monotonic solution to the expert aggregation problem. Mimeo University of Hawaii.

[18] R. Juarez and R Kumar, 2010. Implementing Efficient Graphs in Connection Networks. Under Review, Games and Economic Behavior.

[19] E. Maskin 2003. Bargaining, coalitions and externalities. Working paper, Institute for Advanced Study.

[20] H. Moulin, 2002. Handbook of social choice and welfare.

[21] H. Moulin, 2007. On scheduling fees to prevent merging, splitting and transferring of jobs, Mathematics of Operations Research, 32, 2, 266-283.

[22] H. Moulin, 2009. Proportional Scheduling, split-proofness and merge-proofness. Forthcoming Games and Economic Bahavior.

[23] H. Moulin and S. Shenker, 2001. Strategyproof Sharing of Submodular Costs: Budget Balance versus Effciency, Economic Theory, 18, 3, 511-533.

[24] M. McPherson and L. Smith-Lovin, and J.M. Cook, 2001. Birds of a Feather: Homophily in Social Networks. Annu. Rev. Sociol. 27, 41544.

[25] H. Oszoy, 2007. Coordinated splitting in probabilistic scheduling. Forthcoming International Journal of Game Theory.

[26] H. Oszoy, 2007. A characterization of Bird's rule. Forthcoming Games and Economic behavior.

[27] D. Ray and R. Vohra, 1999. A theory of endogenous coalition structures. Games Econ. Behav. 26, 286336

[28] D. Ray, 2007. A Game-Theoretic Perspective on Coalition Formation. Oxford University Press.

[29] T. Roughgarden, 2005. Selfish routing and the price of anarchy. MIT Press.

[30] T. Roughgarden, A. Mehta, M. Sundararajan, 2005. Beyond Moulin Mechanisms. Forthcoming Games and Economic Behavior.

[31] T. Sonmez, S. Banerjee and H. Konishi, 2001. Core in a simple coalition formation game. Social Choice and Welfare 18(1), 135-153.

[32] W. Thomson, 2003. Axiomatic and game-theoretic analysis of bankruptcy and taxation problems: a survey. Mathematical Social Sciences 45 249297.

[33] S. Yi, 1997. Stable coalition structures with externalities. Games Econ. Behav. 20, 201237.

Computing coalitions
(Revised)

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Abstract

This revision describes the three stability concepts. The main revision is that agents are farsighted until the second step of the simulation, therefore the previous version of the algorithms are not going to work. I describe here the brute force algorithms.

1 The model

Agents identified with different characteristics. We need to check the above algorithms for every characteristic.

Say we have 3 religions, $R1, R2, R3$.

There are five potential partitions of the agents:

$$(R1, R2, R3), (R1R2, R3), (R1, R2R3), (R1R3, R2), (R1R2R3).$$

For every partition, compute the utility that agents get when playing in the second stage of the model.

Thus, $u(R1, R2, R3) = (10, 11, 8)$ means that every agent in religion R1 gets 10 units of utility (call it dollars), every agent in religion 2 get 11 dollars and agent in religion 3 gets 8 dollars.

$u(R1, R2R3) = (14, 1, 8)$ similarly as above, every agent in religion 2 will get 1 dollar.

For every partition we have a utility vector that represents the payment of the agents if they form that coalition and play like that in the second stage of the model. These utilities are coming from the second stage of the model (which I don't control), therefore they are arbitrary.

The computer simulation worst backwards: First it must compute the above utilities for every partition. Then it will find the partition the meets the stability requirements below.

2 Preliminaries

- **Core stability:** No group of agents would be better-off by forming their own coalition.

- **Merge-proofness and Split-proof (MPSP):** Given a partition, no groups of coalition would profit by merging or splitting.

- **No-treat equilibrium (NTE):** If a coalition of agents in S reacts, then a subgroup of $N \setminus S$ can improve and treat at least one agent in S.

We would like to implement the three stability concepts above: Core, NTE and MPSP.

3 Core stability

We say the partition P is core stable if for any subset of religions $S = \{R_{i1}, R_{i2}, \ldots, R_l\}$, it is not the case the $U_i(S, P \setminus S) > U_i(P)$ for all i in S. In other words, no group of agents S is better off by forming their own partition.

Example 1:
$U(R1, R2, R3) = (13, 9, 11)$,
$U(R1R2, R3) = (10, 10, 7)$
$U(R1, R2R3) = (0, 10, 12)$
$U(R1R3, R2) = (1, 0, 13)$
$U(R1R2R3) = (9, 9, 12)$.

In this example the core is empty: $R1R2R3$ is dominated by $(R1R2, R3)$ via colaition 12. $(R1R2, R3)$ is dominated by $(R1, R2, R3)$ via coalition 1. $(R1, R2, R3)$ is dominated by $(R1, R2R3)$ via coalition 23. $(R1, R2R3)$ is dominated by $(R1R3, R2)$ via coalition 13. $(R1R3, R2)$ is dominated by $U(R1R2, R3)$ via coalition 12.

Example 2:
$U(R1, R2, R3) = (13, 9, 11)$,
$U(R1R2, R3) = (10, 10, 7)$
$U(R1, R2R3) = (0, 10, 12)$
$U(R1R3, R2) = (13, 0, 13)$
$U(R1R2R3) = (9, 9, 12)$.

The core is $U(R1R3, R2) = (13, 0, 13)$ because the agent cannot re-organize improving the utility of all the agents (13 are already getting the their maximal possible utility, so if they reorganize, then some of the agents would be worse off). Formally, the algorithm has to check the 7 possible cases.

Computing the core:
There is no smart way to do it. For every partition, it must test whether or not each of the $2^N - 1$ potential coalitions improve by forming their own coalition.

4 MPSP

We say the partition P is MPSP if for any partition S :

i. No subcoalition improves by splitting. That is, there is no $S \subset T \in P$ such that $U_i(S, P \setminus S) > U_i(P)$ for all i in S.

ii. No coalitions in T improve by merging. That is, there is no subset of coalitions $S_1, S_2, \ldots, S_t \in P$ such that $U_i(S^*, P \setminus S) > U_i(P)$ for all i in S^*, where $S^* = S_1 \cup S_2 \cup \cdots \cup S_t$.

Example 3:

$U(R1, R2, R3) = (13, 9, 11),$
$U(R1R2, R3) = (10, 10, 7)$
$U(R1, R2R3) = (0, 10, 12)$
$U(R1R3, R2) = (1, 0, 13)$
$U(R1R2R3) = (9, 9, 12).$

$U(R1, R2, R3)$ is not merge-proof because 2 and 3 can merge and improve $(9, 11) << (10, 12)$.

$(R1R2, R3)$ is not split-proof because 1 can split and be better off.

$(R1, R2R3)$ is MP and SP. It's MP because if R1 and R2R3 merge, then they'll forme the partition R1R2R3 and 2 would be worse off. It's split proof because if R2 or R3 split, then they'll get $(9, 11) << (10, 12)$.

Computing MPSP: We need to test for merge-proofness and Ssplit-proofness separately.

To test split-proofness on the partition P, you need to check that for every partition P, and for every $S \in P$ and element of the partition, and for every subcoalition $T \subset S$, it is not the case that $U_i(T, P \setminus T) > U_i(P)$ for all $i \in T$.

To test merge-proofness on the partition P, you need to check that for every group of coalitions $S_1, \ldots, S_t \in P$, it is not the case that they improve by merging: that is for $S^* = S_1 \cup \cdots \cup S_t$, it is not the case that $U_i(S^*, P \setminus S^*) > U_i(P)$ for all $i \in S^*$.

Note that, when testing split-proofness, any coalition of size larger or equal than one can deviate. However, we have additional restrictions: only coalitions of agents who share the same characteristic can deviate. Thus, for instance if we are dividing the agents across religion, and the agents are partitioned as: R1R2R3, R4, R5, R6R7R8, then only R1, R2, R3, R1R2, R1R3 and R2R3 are feasible split deviations of R1R2R3. We also need to check the feasible split deviations of R6R7R8. If the partition R1R2R3, R4, R5, R6R7R8 is split-proof, then none of the coalitions R1, R2, R3, R1R2, R1R3, R2R3, R6, R7, R8, R6R7, R7R8, R6R8 should be better off by deviating.

On the other hand, when testing merge-proofness, we need to check teh coalitions do no improve by merging. That is, we need to check R1R2R3R4, R1R2R3R5, R1R2R3R6R7R8, R4R6R7R8, etc...

5 No-treat equilibrium (NTE)

If a coalition S is better off by deviating, then there is a threat by another coalition T that makes S worse off.

In theory, the space of responses for the threatening agents is any possible reallocation that makes them better off, and worse off to at least one agent who initial deviated. When testing NTE, and to simplify the calculations, just assume that the agents who remain in the game after the initial agents deviated form a single coalition.

For instance, assume the partition of the agents P1=R1R2R3, R4, R5, R6R7R8.

Example 4:

Assume that R1R2 is better off by deviating, thus their payoff is larger in P2=R1R2, R3, R4, R5, R6R7R8 than in P1. Then for P1 to be a NTE, the remaining agents can reorganize to P3=R1R2, R3R4R5R6R7R8, and weakly improve w.r.t. P2; and at least one agent in R1R2 must be worse off under P3 than under P1 (so this agent is threatened to deviate).

Example 5:

Also notice under NTE, the coalition who is deviating does not necessarily have to be a splitting coalition. For instance, R1R3R4R7 might be deviating, thus their payoff is larger in P4= R1R3R4R7, R2, R5, R6, R8 than in P1. However, since P1 is a NTE, then the remaining agents can reorganize to P5= R1R3R4R7, R2R5R6R8, and they should weakly improve w.r.t. P4; and at least one agent in R1R3R4R7 must be worse off under P5 than under P1.

Example 6:

$U(R1, R2, R3) = (13, 9, 11)$,
$U(R1R2, R3) = (10, 10, 7)$
$U(R1, R2R3) = (0, 10, 12)$
$U(R1R3, R2) = (1, 0, 13)$
$U(R1R2R3) = (9, 9, 12)$.

$(R1R2, R3)$ is a NTE equilibrium because 1 can split and be better off: $U_1(R1, R2, R3) = 13 > 10 = U_1(R1R2, R3)$. However, if that happen, then agents 2 and 3 can merge to R2R3 (threaten agent 1), improve by merging: $U_2(R1, R2R3) = 10 > 9 = U_2(R1, R2, R3)$, $U_3(R1, R2R3) = 12 > 11 = U_3(R1, R2, R3)$ and make R1 worse off: $U_1(R1, R2R3) = 0 < 13 = U_1(R1, R2, R3)$.

6   Conclusions

To summarize, the brute-force computer code should look like this:

1. Compute the outcome of the second step of the simulation for each of the partition of agents.

2. Check one of the stabilty concepts for every characteristic of the agents (religion, race, education, etc)

3. the last step is to choose the representative characteristic, that I would leave to discussion with Sun-Ki and the other SS people. I think we can break ties by choosing the one with the smallest population.

Models of Ethnic Conflict

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1   Bargaining Between Ethnic Groups

1.1   Inefficiency Paradox of War

Why does war happen despite its costs? Given the costs of war, there can exist a peaceful settlement which is Pareto superior to war (Figure 1). From rationalist points of view, Fearon (1995) provided three explanations about what prevents peaceful settlements, while rejecting others.

- *Private information* about relative capabilities or resolve and *incentives to misrepresent* such information: Given these incentives, communication may not allow rational leaders to clarify relative power or resolve without generating a real risk of war.

- *Commitment problems*: one or more states would have an incentive to renege on the terms.

- *Issue indivisibilities*: Some issues will not admit compromise.

Since the indivisibility of issues is not empirically appealing, this note provides models only of commitment problems and of private information. But it is not difficult to develop a model of issue indivisibility by applying the bargaining situation in Figure 1.

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1.2 Basic Setup

Models of ethnic conflict uses the following notations:

- Two ethnic groups: $I \in \{A < B\}$.

- Probability that A wins war: $p \in [0, 1]$.

- Costs of war: c_A, c_B.

- Status quo/ State border: $q \in [0, 1]$.

- Risk-neutral payoffs from benefit: $u_A(x) = x; u_B(x) = 1 - x$.

  - Total benefit is normalized to be one.
  - A's benefit: x.

Subgame perfect Nash equilibrium is employed as a solution.

Implications

- War is unlikely if q is near p. Namely, if the status quo roughly mirrors the distribution of power, neither group prefers war to status quo.

- The length of "no war" range is the sum of war costs $c_A + c_B$ in Figure 1. War is less likely if its costs are larger. (But the model does not explain why war happens.)

2 Commitment Problem

There are two sorts of wars concerning the commitment problem: preventive war and preemptive war. Preventive war arises from the *change in relative power* over time, whereas preemptive war arises from the *first-strike advantage*.

2.1 Preventive War

The extensive-form game of preventive war appears in Figure 2-(a). Suppose that group A is ethnic minority while group B is the majority which has the right to propose the allocation x. p_1 is the probability that group A wins at $t = 1$, and p_2 the probability that group B wins at $t = 2$.

Suppose $p_1 > p_2$ and $p_1 - c_A > 0$. The unique subgame perfect Nash equilibrium is:

- Group A chooses to fight at $t = 1$.

- Group A accepts if and only if $x \geq p_2 - c_A$.

- Group B chooses $x = p_2 - c_A$.

The case without commitment problem appears in Figure 2-(b).

Implications

- Pareto optimal outcome of not fighting cannot be SPNE because the majority group does not have a commitment device on x.

- Conditions for costly war are:

  - Anarchy, lack of third-party enforcement.
  - $p_1 > p_2$: The power of the minority group declines over time.
  - $p_1 - c_A > 0$: Fighting is better than nothing.
    * Enough chance of winning (external military support).
    * War is not very costly (internal nationalistic support).

2.2 Preemptive War

Suppose that the probability that a group wins increases to $p + f$ if it attacks first. The bargaining range appears in Figure 2.

Implications

- The length of "no war" range is $c_A + c_B - 2f$ in Figure 2. The first-strike advantage reduces the bargaining range and makes war more likely.

- If the first-strike advantage is too large ($f > \frac{c_A + c_B}{2}$), a peaceful settlement is impossible.

3 Asymmetry of Information

3.1 Simplest Model

Suppose that group B does not know c_A, but it is common knowledge that c_A follows the uniform distribution: $c_A \sim U\left[\underline{c_A}, \overline{c_A}\right]$. The extensive-form game appears in Figure 4. By backward induction, group A accepts if and only if $x \geq p - c_A$. Thus, the probability of fighting is:

$$\Pr\left(c_A \leq p - x\right) = \frac{p - x - \underline{c_A}}{\overline{c_A} - \underline{c_A}}.$$

Given group A's strategy, group B maximizes its payoff by choosing x,

$$\max_x \left[1 - \frac{p - x - c_A}{\overline{c_A} - \underline{c_A}} \right] (1 - x) + \left[\frac{p - x - c_A}{\overline{c_A} - \underline{c_A}} \right] (1 - p - c_B).$$

By FOC (excluding corner solutions), $x^* = p - \frac{\overline{c_A} - c_B}{2}$. The probability of war is:

$$\frac{1}{2} - \frac{c_B - c_A}{2 \left(\overline{c_A} - \underline{c_A} \right)}.$$

Implications

- Asymmetry of information makes war possible.

- An ethnic group faces a risk-return tradeoff between possibly obtaining bettter terms and a higher probability of not obtaining any settlement at all.

4 War of Attrition

The war-of-attrition model is about how a war ends rather than how it starts. An example of war of attrition is the World War I. In each of successive periods $t = 1, 2, 3, \cdots$, each group simultaneously chooses to fight or to stop fighting. A group which stops earlier than the other loses the battle.

- Group i's payoff from losing the war is: $L_i(t) = - \left(1 + \delta + \delta^2 + \cdots + \delta^{t-1} \right) c_i = - \frac{1 - \delta^t}{1 - \delta}$.

- Group i's payoff from winning the war is: $F_i(t) = L_i(t) + \delta^t$.

The unique stationary and symmetric mixed-strategy subgame perfect Nash equilibrium is that each group i stops the war with probability p_i^* each period. To obtain p_i^*, since it employs a mixed strategies, the payoff from stopping at t is equal to the payoff from fighting at t stopping at $t + 1$:

$$L_i(t) = pF_i(t) + (1 - p) L_i(t + 1).$$

Thus,

$$p_i^* = \frac{1}{1 + \frac{1}{c_i}}.$$

Implications

- The group with larger cost is more likely to stop the war earlier.

- The larger the cost is (or the smaller the benefit from war is), the shorter the war is.

5   References

- Inefficiency paradox of war: Fearon, J. D. (1995) "Rationalist Explanations for War," *International Organization* 49: 379-414.

- Preventive war: Fearon, J. D. (1995) "Ethnic War as A Commitment Problem," Unpublished Paper.

- Bargaining, preemptive war, asymmetry of information: Powell, R. (2002) "Bargaining Theory and International Conflict," *Annual Review of Political Science* 5: 1-30.

- War of Attrition: Fudenberg and Tirole (1991) *Game Theory,* MIT Press.

Criminal conflict as collective punishment

Keisuke Nakao and Sun-Ki Chai

Abstract: While political conflicts have been extensively studied by scholars of International Relations, criminal conflicts have been much less focused especially by theorists in the field. With specific focus on the latter type of conflicts, we address why an individual crime across an ethnic or tribal border often leads to large-scale violence. Along rational choice perspectives, we examine three hypotheses which might explain this puzzle: (i) Avengers penalize any suspects in the culprit's social group because they cannot identify the culprit; (ii) Avengers seek a vicarious punishment on the culprit's significant others, because the vicarious punishment can be more painful for the culprit than a penalty just on himself; (iii) By demanding collective responsibilities, avengers induce an internal control of the culprit from his peers. Historical incidents and recent case studies suggest the third to be most appealing.

Echoing the advancement of Game Theory for the last few decades, political scientists have developed theoretical explanations for why wars can happen despite costs. Using formal models, they powerfully and intriguingly illustrated several processes of how a bargaining breaks down and war subsequently initiates between two parties which struggle for the same resources (e.g., land). Some political scientists labeled this type of wars as political conflicts.[1] On the other hand, theorists in related fields remain less eloquent when they address wars triggered by an alternative cause: crime.[2] For example, the following report about the Nyakyusa people in Tanzania depicts a communal war caused by a single across-village wrongdoing.

"In a case of adultery the injured husband, together with his kinsmen, pursued and attempted to kill, or torture and kill, the adulterer: self-help was not only permitted but expected in this situation, and a man's near kinsmen were obliged to assist him. Neighbours were not obliged to assist in executing vengeance, but they might be victims of it, for if the injured husband did not find the adulterer he might kill any village-mate of his enemy. Such an attack commonly led to war between the two villages."[3]

With specific focus on criminal conflicts, this article aims to address why an individual crime (e.g., robbery, cheating, adultery, murder) often leads to brutal conflict between tribes or ethnic groups. If a crime is one of the real causes of conflicts, the suppression of crimes should reduce the risk of conflicts. We thus start with reversing the puzzle for constructive purposes: How can crimes be deterred and peaceful order be maintained?

Peaceful order as a public good

Once peaceful order is established in a region, it benefits everyone there; i.e., it is non-excludable. Since peaceful order entails economic externalities, its emergence is not necessarily spontaneous through a free-market mechanism. Conceivably acknowledging this property, a classic Political Philosopher maintained that it should be provided by a centralized authority which monopolizes violence and polices wrongdoers.[4] Contemporary counterparts also agreed that the provision of peaceful order is difficult without a powerful state.[5] However, more recent studies reported that peaceful order can exist even in anarchic or weak-state societies which are far beyond the control of a government.[6] Thus, the question becomes even more puzzling. How can peaceful order be maintained *even without a centralized regime*? The theory of collective action would provide some clues to this question.

Rational choice theory of collective action: accessibility and transparency

Rational choice theory holds that collective action is possible when all the participants expect an effective penalty on a deviant. For such a penalty to be credible, each member must be accessible to the rest of the group. (Otherwise, a deviant cannot be penalized.) In addition, the group must be capable of identifying the deviant with sufficient likelihood. Otherwise, the penalty should fall on all the suspects, or at least on some of them selected at random, to deter deviance. A critical drawback in this practice [randomized punishment] is that as the population grows, the indiscriminate penalty becomes more annoying to everyone, and collective action becomes less efficient for the group as a whole. Once the group size exceeds a pivotal capacity, collective action would break down.[7] Thus, the problem of identifying the deviant must be solved for collective action with a sizable population. To this end, the group must retain transparency among its members. To summarize, the rational choice theory suggests that the capabilities of both identifying and penalizing the deviant are the keys for collective action.[8] A dense social network among group members is helpful to conduct these two tasks.

Heterogeneous social networks: bonding vs. bridging social capitals

In a region where several ethnic groups coexist, the social network is not uniformly distributed; i.e., an intra-group network is presumably denser than an inter-group network. A political scientist notably

labeled them "bonding" and "bridging" social capitals.[9] This heterogeneity of social connectedness in an ethnically mixed society may make peaceful order difficult to establish since both accessibility and transparency among individuals, required for collective action as maintained above, are asymmetric across ethnic groups.[10] The lack of daily communication, periodic interactions or common interests across groups may exacerbate the problem.

In addition, there may exist disagreements about the set of normative behavior among different ethnic groups.[11] (An innocent action of a Jew may upset his neighbor Arabs.) This cultural gap can also destabilize inter-ethnic peaceful order.

Three possible mechanisms of criminal conflicts

Applying the theory of collective action to a multi-ethnic society, we hypothesize three mechanisms of criminal conflicts and examine their accountabilities for peace and conflict. We employ (i) informational, (ii) preferential, and (iii) functional approaches to explain criminal conflicts.

Hypothesis (i): lack of transparency

The heterogeneity of social connectedness in a hybrid society implies that the identity and action of someone out of an ethnic tie are presumably less visible than those of coethnics. This relative transparency of intra-group interactions to inter-group ones constitutes one of the characteristics of such a multi-ethnic world. This means that once a crime occurs, it is relatively easy or costless to identify the criminal if he is among the coethnics of the victim, but it is not so if he has no relationship with the victim. If the victim and her ethnic fellows fail to identify the criminal but only find his ethnic background (possibly through his accents, language or appearance), they cannot penalize the criminal without troubling anyone similar to him or his ethnic brethren. This indiscriminate form of vengeance can spark off large-scale violence. In other words, an inter-ethnic crime can cause an ethnic conflict if the identification of the criminal matters. According to this account, the lack of transparency encompassing ethnic groups can spur criminal conflicts. If the criminal remains anonymous, the only way to penalize him is to penalize all the suspects (ex ante), escalating into the spiral of reprisal.

This account for criminal conflicts, however, has a potential limitation. If this identification problem plays a significant role for criminal conflicts, why are target groups of reported vengeance almost always *social*? Why are not they based on other observable categories such as sex, height, age, eye color, or people with glasses? This lack-of-transparency account cannot eliminate the possibility of these appearance-based conflicts, but we seldom hear a conflict between groups split by any of these observable

categories. Such conflicts are largely non-existent. In addition, this account has another drawback that it cannot explain some conflicts which occurred even when the culprits were identified.[12] Thus, although we cannot fully reject the hypothesis based on the lack of transparency, it is not empirically appealing to explain the emergence of criminal conflicts.

Hypothesis (ii): altruism among kinsmen

Economics often assumes self-interested individuals to explain a market mechanism, but the assumption of self interest is probably too strong if it applies to the socially closed relationship especially among kinsmen. We do not intend to claim that altruism reduces the conflict of interests among people and helps to preserve peaceful order. It is trivial.[13] Instead, we consider the claim that *intra-ethnic* altruism can catalyze *inter-ethnic* conflict. To see the mechanism of how altruism matters for inter-ethnic peace and conflict, recall that an effective punishment is essential to deter deviant behavior. If people are purely self-interested, vicarious punishment on a culprit's significant others has no deterrent power against his culpable behavior simply because the culprit has no concern about others. Thus the vicarious punishment makes no sense for self-interested parties. In contrast, if people are altruistic toward kinsmen, the vicarious punishment can be more painful and preventive than punishment just on the (altruistic) culprit. Knowing this effect created by altruism, avengers may threaten to target both the culprit and his kinsmen to show off the grim consequence of a culpable conduct.

Note that although altruism creates the incentives for group-wide feuds, it also realizes the effective suppression of deviant behavior and thus assists to enforce peaceful order as well. It is because rational avengers seek not penalty per se but peaceful regime backed by the penalty. In this sense, peace and criminal conflict are opposite sides of the same coin.[14]

This form of feud was reported from North American Indians: "The Family to revenge this Death appointed one of their Tribe not to kill the Murderer, but his dearest Friend considering he would suffer more in the Death of the Person he loved than in dying himself."[15] However, we do not find any other supportive incidents for Hypothesis (ii) so far.

Hypothesis (iii): in-group policing

The third account focuses on the functional aspects of criminal conflicts. A critical problem in enforcing inter-ethnic peaceful order lies in the weakness of out-group network relative to in-group counterpart. As argued above, this weakness makes both out-group monitoring and controlling difficult and therefore

undermines peaceful order encompassing several ethnic groups. The third mechanism, we are exposing next, attempts to fill in the gap between in-group and out-group network densities.

The third account holds that once an inter-ethnic transgression happens, the avengers may retaliate not only the transgressor himself but also his ethnic brethren because the avengers seek to urge the target group to discipline its own transgressor. To put it another way, under the threat of such reprisal, people are motivated to monitor and control their brethren not to misbehave against ethnic outsiders since they are scared of communal war against other ethnic groups. The threat of conflict thus helps to develop an informal in-group policing regime in the target group which may contribute to the inter-ethnic peaceful order. Anthropologists also suggested the possibility of such a mechanism. For instance, it was reported that Eskimos around Point Barrow were influenced by the fear of feud and were encouraged to suppress any culpable behavior that could lead to violence.[16]

In rational choice perspectives, this pattern of group-level reprisal makes sense in at least two regards to collective action in a heterogeneous society. First, mutual in-group monitoring, induced by the threat of conflict, can be much cheaper and more effective than monitoring from outside, and in-group monitoring may help to reduce misbehavior. Coethnic fellows are in a better position to monitor themselves than ethnic outsiders.

Second, because of the tight social connectedness in an ethnic group, in-group punishment, also induced by the threat of conflict, can also be cheaper and more effective than an individual punishment from outside. Peers can impose various kinds of penalties on those who misbehave. For example, just peers' social ostracism or boycott of business can be sufficient to discourage opportunistic transgressions. On the other hand, it is likely to be more difficult and costly for outsiders to effectively threaten individual wrongdoers because of the lack of dense social tie between them.

For these two reasons above, "group-level sanctions may be expected to outperform individual-level ones."[17] This in-group policing account for criminal conflict is consistent with the following finding from medieval Iceland: "group liability ... rendered the feud or fear of feud much more effective as an instrument of social control than it would otherwise have been if only the actual wrongdoer suffered the consequences of his actions."[18] Because coethnics are more advantageous in both monitoring and controlling than outside entities, the external avengers utilize these advantages to fill in the in- vs. out-group gap of the network densities by taking hostile actions. This physical confrontation by outsiders may further consolidate the in-group policing regime. Because a wrongdoer is a potential danger to his

neighbors, he would be purged from his village to evade the escalation of violence. The report about Nyakyusa of Tanzania above says: "thieves and adulterers were liable to be banished from a village just like witches and sorcerers, for they too brought misfortune on their fellows."[19] This sort of social ostracism may work as a penalty to suppress culpable behavior.

To summarize, out-group peaceful order is enforced by in-group policing, while in-group policing is induced by out-group conflict. Although it cannot be asserted that the third mechanism is always the case, it is richer in supportive incidents than the two others. In addition to the incidents of Eskimos in Alaska, medieval Icelanders, and the Nyakyusa people in Tanzania as we exposed above, we found other cases as well. For instance, famous Lawrence of Arabia reported, in his autobiography, that on the way to see the king of Iraq, he met a lonely Arab man who was excluded from the Arab community and lived alone because he had murdered a Christian in the past.[20] The in-group policing mechanisms were also found in Poland and the Ottoman empire which allowed large degrees of autonomy to ethnic minorities.[21]

This in-group policing account for inter-ethnic criminal conflicts suggests that the success of inter-ethnic peace hinges critically on each group's quality of in-group policing. As a consequence, groups with high qualities of in-group policing can enjoy long-lasting and stable peace, whereas those with low qualities of policing tend to suffer more frequent and longer disputes with other groups. In the absence of Leviathan, in-group policing can matter for peaceful order. Without effective in-group policing, conflict might be inevitable.

Collective punishments practiced in a modern society

Applications of the in-group policing regime and collective punishment can be broadly observed even in a modern society where individual rights are highly respected. For production in team, the performances of workers are jointly evaluated in many firms on the ground that an employer expects peer pressures among them.[22] Group lending for microcredit is another instance. Because debtors are jointly liable, they tend to encourage each other's scheduled repayment.[23] For other instances, editors of scholarly journals may also expect a similar role from coauthors who are at better positions to repress each other's academic misconducts; it is ruled in Britain and Japan that a Councilor shall lose his seat in the Parliament if his secretary conducts a criminalized act such as bribe; for corporate governance, shareholders are liable for the torts and crimes of their corporation.

Conclusion

Based on the rational choice theory of collective action, we presented and examined three hypothetical accounts for criminal conflicts: (i) informational; (ii) preferential; and (iii) functional. For all the three hypotheses, we argue, the disparity in density between intra-group and inter-group networks is the key which may hinder the development of inter-group peaceful order.

Hypothesis (i) explains the spiral of communal violence by the identification problem of an inter-ethnic transgressor. Hypothesis (ii) holds that inter-ethnic retaliation is collective because avengers exploit altruistic concerns among kinsmen to discourage inter-group opportunism. Hypothesis (iii) maintains that external confrontation between tribal or ethnic groups is called for to develop internal social control within each group. Although the first two hypotheses cannot be fully rejected, the most appealing would be the third.

Notes

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1. This categorical distinction between political and criminal conflicts follows Chabal and Daloz (1999, p. 83).
2. Exceptions include Fearon and Laitin (1996); Bendor and Mookherjee (2008); Nakao (2009).
3. This is a citation from Wilson (1983, p. 149). Another example is from southern Egypt: a Christian shopkeeper's insult on a Muslim and his refusal to apologize led to inter-ethnic turmoil (The Economist 8 Jan. 2000). For other related incidents, see *infra* footnotes 12, 15, 16, and 18.
4. This philosopher is apparently Hobbes (2009).
5. The most notable work along this argument is Horowitz (1985).
6. For instance, see Fearon and Laitin (1996); Bowen (1996); Gould (1999).
7. The theoretical demonstration of this prediction appears in Bendor and Mookherjee (1987).

8. For more detailed argument, see Hechter (1984; 1987).

9. See Putnam (2001) for detail.

10. These points are also noted by Hardin (1995, pp. 118-9). "First, groups are apt to have better information about their members' actions than about the actions of people in other groups. Second, groups are apt to have fairly straightforward reasons for imposing order on their own members if they are to be held responsible for their fellow members' actions."

11. Hechter (1987, p. 178), for instance, argues that cultural disparities tend to generate misinterpretation of behavior.

12. This form of an incident can be seen among Nyakyusa. Moore (1978, p. 104) reported: "Intervillage adultery cases sometimes blew up into intervillage war, when the wronged husband and his supporters killed a covillager of the adulterer in reprisal." It suggests that the target of vengeance is not the adulterer himself but his covillager. Reid (1999, p. 93) also reported a case of North American Indians.

13. In contrast, Bernheim and Stark (1988) and Nakao (2008) argue that altruism may not necessarily assist collective action.

14. In this sense, the rational choice theory of criminal conflicts mirrors Gluckman's (1955) conflict theory in Anthropology.

15. This is a citation from Nicholas Garry's diary in Reid (1999, p. 93).

16. See Colson (1974, p. 41).

17. The mechanism of collective sanctions is well explained in Levinson (2003).

18. See Miller (1990, p. 197).

19. See *supra* footnote 3.

20. See Lawrence (1935).

21. Dubnow (1916, pp. 103-106, 188-193) reported that the Jews maintained an autonomous community in Poland. In contrast, Dumont (1982, pp. 221-230) showed that the Jews suffered from constant persecution by other ethnic groups in the Ottoman empire.

22. Kandel and Lazear (1992) pointed out this relative merit of the joint performance evaluation in team production over alternatives.

23. For a theoretical account for the peer pressure among debtors, see Banerjee, Besley and Guinnane (1994).

References

Banerjee, A.V., T. Besley and T.W. Guinnane. 1994. "Thy Neighbor's Keeper: The Design of a Credit Cooperative with Theory and a Test." *Quarterly Journal of Economics*. Vol. 109, No. 2, pp. 491-515.

Bernheim, B.D. and O. Stark. 1988. "Altruism with the Family Reconsidered: Do Nice Guys Finish Last?" *American Economic Review*. Vol. 78, No. 5, pp. 1034-1045.

Bendor, J. and Mookherjee, D. 1987. "Institutional Structure and the Logic of Ongoing Collective Action." *American Political Science Review*. Vol. 81, No. 1, pp. 129-154.

Bendor, J. and D. Mookherjee. 2008. "Communitarian versus Universalistic Norms." *Quarterly Journal of Political Science*. Vol. 3, No. 1, pp. 1-29.

Bowen, J.R. 1996. "The Myth of Global Ethnic Conflict." *Journal of Democracy*. Vol. 7, No. 4, pp. 3-14.

Chabal, P. and J. Daloz. 1999. *Africa Works: Disorder as Political Instrument*. Bloomington: Indiana University Press.

Colson, E. 1974. *Tradition and Contract*. Chicago: Aldine.

Dubnow, S.M. 1916. *History of the Jews in Russia and Poland*, Vol. 1, Trans. Friedlaender, I., Philadelphia: Jewish Publication Society of America.

Dumont, P. 1982. "Jewish Communities in Turkey during the Last Decades of the 19th Century," In *Christians and Jews in the Ottoman Empire*, Vol. 1, ed. Braude, B. and Lewis, B., New York: Holmes and Meiler.

[Economist] 2000. "Egypt's Vulnerable Copts." *The Economist.* 8 January 2000, p. 41.

Fearon, J.D. and D.D. Laitin. 1996. "Explaining Interethnic Cooperation." *American Political Science Review*. Vol. 90, No. 4, pp. 715-735.

Gluckman, M. 1955. *Custom and Conflict in Africa*. Glencoe: The Free Press, 1955.

Gould, R.V. 1999. "Collective Violence and Group Solidarity: Evidence from a Feuding Society." *American Sociological Review*. Vol. 64, No. 3, pp. 356-380.

Hardin, R. 1995. *One for All*. Princeton: Princeton University Press.

Hechter, M. 1984. "When Actors Comply: Monitoring Costs and the Production of Social Order." *Acta Sociologica*. Vol. 27, No. 3, pp. 161-183.

Hechter, M. 1987. *Principles of Group Solidarity*. Berkeley: University of California Press.

Hobbes, T. 2009. *Leviathan*. New York: Oxford University Press.

Horowitz, D. 1985. *Ethnic Groups in Conflict*. Berkeley: University of California Press.

Kandel, E. and E.P. Lazear. 1992. "Peer Pressure and Partnerships." *Journal of Political Economy.* Vol. 100, No. 4, pp. 801-817.

Lawrence, T.E. 1935. *Seven Pillars of Wisdom*. Garden City: Doubleday, Doran & Company, Inc.

Levinson, D.J. 2003. "Collective Sanctions." *Stanford Law Review.* Vol. 56, pp. 345-428.

Miller, W. I. 1990. *Bloodtaking and Peacemaking*. Chicago, University of Chicago Press.

Moore, S. F. 1978. *Law as Process: An Anthropological Approach*. London: Routledge.

Nakao, K. 2008. "Can Altruism Hinder Cooperation." *Economics Bulletin*. Vol. 4, No. 26, pp. 1-6.

Nakao, K. 2009. "Creation of Social Order in Ethnic Conflict." *Journal of Theoretical Politics.* Vol. 21, No. 3, pp. 365-394.

Putnam, R. 2001. *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.

Reid, J.P. 1999. *Patterns of Vengeance*. Ninth Judicial Circuit Historical Society.

Wilson, M. 1983. *Good Company*. Westport: Greenwood Press.

A Multi Player Conflict and Distribution Model

I. ONE STAGE GAME

- $L \geq 2$ denotes the number of players
- $\Pi_i \geq 0$ denotes the total amount of resources available to player i
- $\theta_i = (\theta_{i,1}, \ldots, \theta_{i,L})$ denotes player i's decision vector where
  - $\theta_{i,j} \geq 0$, $i \neq j$, denotes the amount of resources invested by player i for a conflict with player j
  - $\theta_{i,i} \geq 0$ denotes the amount of resources of player i not invested for any conflict. We have, for all $i = 1, \ldots, L$,
  $$\sum_j \theta_{i,j} = \Pi_i$$

- $I \in [0,1]$ denotes the probability with which the institution will succeed in preventing all conflicts in which case no resources will be lost or transferred.
- With probability $1 - I$, the institution will fail. Two things will happen as a result:
  - A certain fraction, say $c \in [0,1]$, of each player i's resources invested for conflict will be spent. We will denote the remaining resources of player i after subtracting its expenditures by
  $$\bar{\Pi}_i := \Pi_i - c \sum_{j \neq i} \theta_{i,j}$$
  Note that
  $$\bar{\Pi}_i = (1-c)\Pi_i + c\theta_{i,i}$$

  - There will be a conflict between each pair of players i and j whenever $\theta_{i,j} + \theta_{j,i} > 0$. The winner of a conflict between players i and j will be player i with probability
  $$\frac{\theta_i}{\epsilon + \theta_i + \theta_j}$$
  where $\epsilon > 0$ is a small number. When player i wins a conflict with player j, player i will receive
  $$\frac{\lambda \bar{\Pi}_j}{L - 1}$$
  from player j, where $\lambda \in [0,1]$ denotes the fraction of unspent resources of a player that can be transferred to other players.

- $\bar{U}_i$ denotes player i's expected utility when player i has zero altruism towards all other players, and it is given by
$$\bar{U}_i = I\Pi_i + (1 - I) \left(\bar{\Pi}_i + \frac{\lambda}{L-1} \sum_{j \neq i} \frac{\theta_{i,j}\bar{\Pi}_j - \theta_{j,i}\bar{\Pi}_i}{\epsilon + \theta_{i,j} + \theta_{j,i}} \right)$$

- U_i denotes player i's true expected utility when player i has nonzero altruism towards other players, and it is given by
$$U_i = \bar{U}_i + \sum_{j \neq i} \beta_{i,j} \bar{U}_j$$

where $\beta_{i,j} \in [-1, 1]$ denotes the level of player i's altruism towards player j.

II. COMPUTATION OF AN EQUILIBRIUM

A profile of decisions $\theta^* = (\theta_1^*, \ldots, \theta_L^*)$ is called an equilibrium if, for all $i = 1, \ldots, L$,

$$U_i(\theta_i^*, \theta_{-i}^*) = \max_{\theta_i \in \Delta_i} U_i(\theta_i, \theta_{-i}^*)$$

where the notation θ_{-i} is used to denote the collection of the decision vectors of all players other than player i, i.e.,

$$\theta_{-i} := (\theta_1, \ldots, \theta_{i-1}, \theta_{i+1}, \ldots, \theta_L)$$

and Δ_i is player i's constraint set, i.e.,

$$\Delta_i := \{\theta_i : \theta_{i,j} \geq 0, \text{ for all } j, \text{ and } \sum_j \theta_{i,j} = \Pi_i\}.$$

In general, an equilibrium may or may not exist, and also there may be multiple equilibria. Note that the strategy sets Δ_i are convex and compact subsets of $\mathcal{R}^L$, and the expected utility functions U_i are continuous in $(\theta_1, \ldots, \theta_L)$. Furthermore, the numerical examples suggest that the expected utility functions U_i are concave in θ_i for each fixed $(\theta_1, \ldots, \theta_{i-1}, \theta_{i+1}, \ldots, \theta_L)$. If this is indeed the case, then one can conclude the existence of an equilibrium based on the concave game framework; see [1]. For the time being, we will set aside the questions on the existence and uniqueness of an equilibrium. Instead, we will assume that there exists at least one equilibrium, and focus on obtaining one equilibrium as the limiting behavior of a dynamic process. One such dynamic process is called *Gradient Play* which has its roots in the well-known gradient ascent method for optimization problems. Gradient play has also been considered as a model for learning in games where the players are not very "sophisticated".

Gradient Play is an iterative procedure such that players start with some initial choice for their decisions

$$\theta(1) = (\theta_1(1), \ldots, \theta_L(1)).$$

Afterwards, at each step $k \geq 1$, each player i updates its decision vector as

$$\theta_i(k+1) = P_{\Delta_i}\left(\theta_i(k) + s(k) \left.\frac{\partial U_i}{\partial \theta_i}\right|_{\theta(k)}\right)$$

where

- $P_{\Delta_i}(\tilde{\theta}_i)$ denotes the projection of $\tilde{\theta}_i$ onto the constraint set Δ_i, i.e.,

$$P_{\Delta_i}(\tilde{\theta}_i) = \text{argmin}_{\theta_i \in \Delta_i} |\theta_i - \tilde{\theta}_i|$$

- $s(k) > 0$ denotes the step size satisfying $\lim_{k \geq 1} s(k) = 0$ and $\sum_{k \geq 1} s(k) = \infty$, for example, $s(k) = 1/t$
- $\frac{\partial U_i}{\partial \theta_i}$ denotes the first-order partial derivative of U_i with respect to θ_i.

We provide explicit expressions for $P_{\Delta_i}(\tilde{\theta}_i)$ and $\frac{\partial U_i}{\partial \theta_i}$ in Appendix. In general, Gradient Play may or may not converge. However, if converges, Gradient Play must converge to an equilibrium. A reasonable criterion for checking numerical convergence would be to check if the size of $\frac{\theta_i(k+1) - \theta_i(k)}{s(k)}$ falls below a small threshold, for all i.

APPENDIX

- $P_{\Delta_i}(\tilde{\theta}_i)$ is the minimizer of

$$\min_{\theta_i} \frac{1}{2}(\theta_{i,1} - \tilde{\theta}_{i,1})^2 + \ldots + \frac{1}{2}(\theta_{i,L} - \tilde{\theta}_{i,L})^2$$

subject to

$$-\theta_{i,1} \leq 0, \ldots, \theta_{i,L} \leq 0 \qquad \text{and} \qquad \theta_{i,1} + \ldots + \theta_{i,L} - \Pi_i = 0.$$

The Lagrangian for this problem is given as

$$\begin{aligned} \mathcal{L} &= \frac{1}{2}(\theta_{i,1} - \tilde{\theta}_{i,1})^2 + \ldots + \frac{1}{2}(\theta_{i,L} - \tilde{\theta}_{i,L})^2 \\ &\quad - \mu_{i,1}\theta_{i,1} - \ldots - \mu_{i,L}\theta_{i,L} - \mu_{i,L+1}(\theta_{i,1} + \ldots + \theta_{i,L} - \Pi_i) \end{aligned}$$

where $\mu_{i,1}, \ldots, \mu_{i,L+1}$ are the Lagrange multipliers. If $\bar{\theta}_i$ is the minimizer, then the following should be satisfied, for all $j = 1, \ldots, L$

$$\frac{\partial \mathcal{L}}{\partial \theta_{i,j}}\bigg|_{\bar{\theta}_i} = \bar{\theta}_{i,j} - \tilde{\theta}_{i,j} - \mu_{i,j} + \mu_{i,L+1} = 0, \qquad \mu_{i,j} \geq 0, \qquad \mu_{i,j}\bar{\theta}_{i,j} = 0.$$

Assume that

$$\tilde{\theta}_{i,j_1} \geq \ldots \geq \tilde{\theta}_{i,j_L}.$$

If $\bar{\theta}_{i,j_k} > 0$, then

$$\bar{\theta}_{i,j_{k-1}} = \tilde{\theta}_{i,j_{k-1}} + \mu_{i,j_{k-1}} - \mu_{i,L+1} \geq \tilde{\theta}_{i,j_k} - \mu_{i,L+1} = \bar{\theta}_{i,j_k} > 0.$$

Hence there exists a $p \in \{1, \ldots, L\}$ such that

$$\begin{aligned} \bar{\theta}_{i,j_\ell} &= \tilde{\theta}_{i,j_\ell} - \mu_{i,L+1} > 0, \qquad \ell = 1, \ldots, p \\ \bar{\theta}_{i,j_\ell} &= \underbrace{\tilde{\theta}_{i,j_\ell} - \mu_{i,L+1}}_{\leq 0} + \mu_{i,j_\ell} = 0, \qquad \ell = p+1, \ldots, L. \end{aligned}$$

This implies that

$$\mu_{i,L+1} = \frac{\sum_{\ell=1}^{p} \tilde{\theta}_{i,j_\ell} - \Pi_i}{p}. \tag{1}$$

In summary, find $p \in \{1, \ldots, L\}$ such that

$$\begin{aligned} \tilde{\theta}_{i,j_\ell} - \mu_{i,L+1} &> 0, \qquad \ell = 1, \ldots, p \\ \tilde{\theta}_{i,j_\ell} - \mu_{i,L+1} &\leq 0, \qquad \ell = p+1, \ldots, L \end{aligned}$$

where $\mu_{i,L+1}$ is as in (1). Then, set

$$\begin{aligned} \bar{\theta}_{i,j_\ell} &= \tilde{\theta}_{i,j_\ell} - \mu_{i,L+1}, \qquad \ell = 1, \ldots, p \\ \bar{\theta}_{i,j_\ell} &= 0, \qquad \ell = p+1, \ldots, L. \end{aligned}$$

-

$$\frac{\partial U_i}{\partial \theta_i} = \frac{\partial \bar{U}_i}{\partial \theta_i} + \sum_{j \neq i} \beta_{i,j} \frac{\partial \bar{U}_j}{\partial \theta_i}$$

where

$$\frac{\partial \bar{U}_i}{\partial \theta_{i,i}} = (1 - I)c \left(1 - \frac{\lambda}{L - 1} \sum_{j \neq i} \frac{\theta_{j,i}}{\epsilon + \theta_{i,j} + \theta_{j,i}} \right)$$

$$\frac{\partial \bar{U}_i}{\partial \theta_{i,j}} = (1 - I)\frac{\lambda}{L - 1} \frac{\epsilon \bar{\Pi}_j + \theta_{j,i}(\bar{\Pi}_j + \bar{\Pi}_i)}{(\epsilon + \theta_{i,j} + \theta_{j,i})^2}, \ j \neq i$$

$$\frac{\partial \bar{U}_j}{\partial \theta_{i,i}} = (1 - I)\frac{\lambda}{L - 1} \frac{c\theta_{j,i}}{\epsilon + \theta_{j,i} + \theta_{i,j}}, \ j \neq i$$

$$\frac{\partial \bar{U}_j}{\partial \theta_{i,k}} = -(1 - I)\frac{\lambda}{L - 1} \frac{\epsilon \bar{\Pi}_k + \theta_{k,i}(\bar{\Pi}_k + \bar{\Pi}_i)}{(\epsilon + \theta_{k,i} + \theta_{i,k})^2} I\{j = k\}, \ j \neq i, \ , \ k \neq i$$

References

[1] J. B. Rosen, "Existence and uniqueness of equilibrium points for concave $n-$person games," *Econometrica*, vol. 33, no. 3, pp. 520–534, 1965.

Coherence Model Applied to Aftermath of Coalition Interaction

In order to calculate expected regret in our simplified setup, we need to examine effects from the individual level, even though we have not yet addressed the problem of how to ensure an individual's contribution to a coalition's resource allocation profile $\theta_{i,1} \cdots \theta_{i,L}$. We will assume for simplicity that all contributions are made uniformly by all members of a coalition. In other words, each member n of coalition i with population σ_i will have an individual resource allocation profile $(\tau_{n,i,1} \cdots \tau_{n,i,L})$, where $\tau_{n,i,L}$ are the same for all n belonging to i.

- $\tau_{n;i,j}$ is n's investment on behalf of coalition i against coalition j.

- ω_i is the set of individuals defined by the coalition index i.

$$\forall n \in \omega_i, j \in [1, L] : \tau_{n;i,j} \equiv \theta_{i,j}/\sigma_i.$$

Likewise, all rewards and losses will be distributed uniformly, hence if coalition i defeats coalition j, then member n of coalition i will win $\lambda \bar{\pi}_j/(\sigma_i(L-1))$ from that particular conflict. If i loses to coalition j, then it will lose $\lambda \bar{\pi}_i/(\sigma_i(L-1)))$ in the conflict, and in either case it will lose $c\tau_{n,j}$ of its investment on behalf of i in conflict with j.

Recall that we set a ceiling to $\lambda \bar{\pi}_i/(L-1)$ on the total amount that can be won in any victoriaous conflict with i, so that even if i loses all its conflicts, it still cannnot be left with remaning $\pi_i < 0$.

We typically consider coalitions that are large enough so that the individual's resource allocation in conflict does not have sufficient effect on the coalition's chance's of winning to make it worthwhile for the individual to make her contribution if she cares only about her personal net gain. It is one of the most straightforward findings in collective action theory to show that if contributions are distributed evenly, then this will be true for any but the fairly small coalitions. If altruism is taken into consideration, however, this can substantially change an individual's incentives.

In order to calculate expected regret, we must know the expected benefit to an individual if he/she had failed to provide his or her contribution to the coalition, even though we assume that this contribution has taken place, compared to the expected utility given that she did contribute. Because utility is linear as function of the gains and losses from specific interactions, we can calculate an individual's expected regret for all interactions as a sum of the expected regret for these interactions.

If she makes her contribution $\tau_{n;i,j}$ for interaction with coalition j, member n of i will have *a priori* expected payoff (ignoring altruism) of:

$$\bar{U}_{n;i,j}^{contribute} = \phi_n + (1-I)\left(\frac{\theta_{i,j}}{\epsilon + \theta_{i,j} + \theta_{j,i}} \frac{\lambda \bar{\pi}_j}{\sigma_i(L-1)} - \frac{\theta_{j,i}}{\epsilon + \theta_{i,j} + \theta_{j,i}} \frac{\lambda \bar{\pi}_i}{\sigma_i(L-1)} - c\tau_{n;i,j}\right),$$

where

- ϕ_n stands for the individual n's existing power endowment, such that

$$\pi_i = \sum_{n \in \omega_i} \phi_n.$$

$\frac{\theta_{i,j}}{\epsilon + \theta_{i,j} + \theta_{j,i}}$ stands for the probability of winning if all members of i and j make their required contribution (and the political intitutions does not prevent conflict). $\frac{\lambda \bar{\pi}_j}{\sigma_i(L-1)}$ stands for the amount that n will gain personally from such a victory.

Likewise, $\frac{\theta_{j,i}}{\epsilon + \theta_{i,j} + \theta_{j,i}}$ is the probability of losing under the same cirumstances, as well as the amount $\frac{\lambda \bar{\pi}_i}{\sigma_i(L-1)}$ that that would be expropriated from the member under such circumstances.

$c\tau_{n;i,j}$ represents the amount that the member would lose under any circumstances due to to her contribution to the collective θ_i.

In the case where individual n withholds her contribution, n's expected payoff will be

$$\bar{U}_{n;i,j}^{freeride} = \phi_n + (1-I)\left(\frac{\theta_{i,j}^{-n}}{\epsilon + \theta_{i,j}^{-n} + \theta_{j,i}} \frac{\lambda \bar{\pi}_j}{\sigma_i(L-1)} - \frac{\theta_{j,i}}{\epsilon + \theta_{i,j}^{-n} + \theta_{j,i}} \frac{\lambda \bar{\pi}_i}{\sigma_i(L-1)} \right).$$

where

- $\theta_{i,j}^{-n} \equiv \theta_{i,j} - \tau_{n;i,j}$

The prospective expected regret for n will be the difference between the second expected payoff (no contribution) and the first (contribution). It is straightforward to note that the larger σ_i becomes, the less likely it becomes that the individual's contribution will increase her expected payoff, and hence (a self-centered) individual n would in general not contribute $\tau_{n;i,j}$

However, in our model, prospective expected regret is not relevant because individuals will know about the outcomes of conflict immediately after it occurs, and expected regret will be retrospective.

The more straightforward case is where their coalition loses. If n contributes, her payoff for i's unsuccessful conflict with j will be

$$\bar{U}_{n;i,j}^{contribute,lose} = -\frac{\lambda \bar{\pi}_i}{\sigma_i(L-1)} - c\tau_{n;i,j}.$$

If n had not contributed resources to conflict, it would be

$$\bar{U}_{n;i,j}^{freeride,lose} = -\frac{\lambda \bar{\pi}_i}{\sigma_i(L-1)},$$

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leading to "altruism-free" regret of

$$\bar{D}_{n;i,j}^{contribute,lose} = c\tau_{n;i,j}.$$

It is not quite as simple as it might seem at first glance, because an individual must calculate the effect any forgone non-contribution would have had on her coalition's probabilitry of victory. We assume that individuals believe that there is an unseen state of the universe variable $\upsilon_{i,j}$ distributed uniformly across $[0,1]$, such that if the *a priori* probability of winning is $\psi_{i,j}$, then winning will occur iff $\upsilon_{i,j} < \psi_{i,j}$. Given this, if a coalition lost, then $\upsilon_{i,j} \geq \psi_{i,j}$, so any change in collective choice that would have lowered $\psi_{i,j}$ would not have changed the outcome. Given that the coalition lost, the individual's failing to contribute to the conflict would not have changed this fact.

Preference change in the coherence model is based upon regret over preferences that include altruism, in this case altruism over the payoffs of other individuasl. However, the individual's lack of contribution would also not have affected (altruism-free) payoffs for the individual's coalition members, since the losses of other members are simply a proportion of their present power. As a result, no regret is generated by outcomes fof the individual's own coalition.

This is not true for the outcomes of the opposing coalition. In particular, the individual's contribution reduces $\lambda\bar{\pi}_i$, the reward for winning coalition j, by $\lambda\tau_{n;i,j}$.

Hence the actual expected regret is

$$D_{n;i,j}^{contribute,lose} = max\left(c\tau_{n;i,j} + \frac{\lambda\tau_{n;i,j}}{\sigma_j}\sum_{m\in\omega_j}\beta_{n,m},0\right).$$

.

You can see here that if $\beta_{n,m}$ are sufficiently negative, this may actually reduce expected regret enough so that the 0 constraint is binding, hence preserving coherence.

If not, then coherence can be restored by reducing the $\beta_{n,m}$ for $m \in \omega_j$ sufficiently such that

$$\sum_{m\in\omega_j}\bar{\beta}_{n,m} = -\frac{c\sigma_j}{\lambda}$$

where

- $\bar{\beta}_{n,m}$ is the adjusted, new $\beta_{n,m}$ that will hold for the next period.

We can define:

- $\forall n, m \in i : \Delta\beta_{n,m;j}$ is the change in $\beta_{n,m;j}$ resulting from i's conflict with j.

We assume, again for simplicity, that altruisms $\beta_{n,m}$ are adjusted uniformly by n for all members of j, i.e. $\Delta\beta_{n,m;j}$ are the same for all $m \in j$. We can define

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- $\gamma_{n;j,j}$ to stand for change in $\beta n, m; j$ towards each member of j.

Thus

$$\gamma_{n;j,j} = -\frac{\sum_{m \in \omega_j} \beta_{n,m}}{\sigma_j} - \frac{c}{\lambda}.$$

This leads to a predicted adjustment in altruism under losing conditions such that:

$$contribution(n) \land lose(i) \Rightarrow \forall m \in j : \bar{\beta}_{n,m} = \beta_{n,m} - \frac{\sum_{m \in \omega_j} \beta_{n,m}}{\sigma_j} - \frac{c}{\lambda}.$$

The case where a coalition wins is more complicated, since the contribution an individual makes may have been responsible for the coalition's victory. amd this has an effect on both the payoffs of her own coalition and that of the losing one.

In the case of victory, the individual's contribution may have had an impact on the ability of the coalition to win, although there is no way of being certain even after the fact. Assuming bayesian updating on the part of the individual, if a coalition wihs, then an individual will infer that $\upsilon_{i,j}$ in fact follows a uniform distribution over $[0, \psi_{i,j}] = [0, \theta_{i,j}/(\epsilon + \theta_{i,j} + \theta_{j,i}]$, which means that there was a probability of

$$\frac{\theta_{i,j}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{\theta_{i,j} - \tau_{n;i,j}}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j,i}}$$

that her contribution was necessary and sufficient for the victory. In that case, the chosen action of contribution had a relative impact on n's expected utility of

$$\bar{D}_{n;i,j}^{contribute,win} = \lambda \Bigg(\frac{\theta_{i,j} \bar{\pi}_j (\sum_{m \in \omega_i} \beta_{n,m}/\sigma_i - \sum_{m \in \omega_j} \beta_{n,m}/\sigma_j)}{\epsilon + \theta_{i,j} + \theta_{j,i}}$$
$$-\frac{(\theta_{i,j} - \tau_{n;i,j})(\bar{\pi}_j \sum_{m \in \omega_i} \beta_{n,m}/\sigma_i - (\bar{\pi}_i + \tau_{n:i,j}) \sum_{m \in \omega_j} \beta_{n,m}/\sigma_j)}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \Bigg) - c\tau_{n;i,j}$$

compared to freeriding, where

- $\bar{D}_{n;i,j}^{contribute,win}$ is the "unconstrained" expected regret for a binary choice set, i.e. the difference in expected utility between the choice made and that forgone.

Note that the effect pf the contribution to the conflict on members of opposing coalition j is based not only upon reduction in their their marginal effect on winning, but also on the effect of forgoing $\tau_{n;i,j}$ in increasing $\bar{\pi}_i$.

Hence the actual expected regret is $D_{n;i,j}^{contribute,win} = max(\bar{D}_{n;i,j}^{contribute,win}, 0)$.

If the 0 constraint is not binding, to restore coherence we must have $\bar{\beta}_{n,m}$ so that,
Separating into terms for $m \in \omega_i$ and $m \in \omega_j$,

$$\lambda \bar{\pi}_j \frac{\sum_{m \in \omega_i} \bar{\beta}_{n,m}}{\sigma_i} \left(\frac{\theta_{i,j}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{\theta_{i,j} - \tau_{n;i,j}}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right) -$$

$$\lambda \frac{\sum_{m \in \omega_j} \bar{\beta}_{n,m}}{\sigma_j} \left(\frac{\bar{\pi}_i \theta_{j,i}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{(\bar{\pi}_i + \tau_{n:i,j})(\theta_{i,j} - \tau_{n;i,j})}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right) - c\tau_{n;i,j} = 0.$$

There are a number of ways to accomplish adjustment, but for simplicity taking the principle of equal absolute adjustment of altruism for each relevant individual within each group, but having the total adjustment in altruism from the status quo be the same between groups, we get an adjustment of

$$\lambda \bar{\pi}_j \left(\frac{\sum_{m \in \omega_i} \bar{\beta}_{n,m}}{\sigma_i} + \gamma_{n;i,j} \right) \left(\frac{\theta_{i,j}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{\theta_{i,j} - \tau_{n;i,j}}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right) -$$

$$\lambda \left(\frac{\sum_{m \in \omega_j} \beta_{n,m}}{\sigma_j} - \gamma_{n;i,j} \right) \left(\frac{\bar{\pi}_i \theta_{j,i}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{(\bar{\pi}_i + \tau_{n:i,j})(\theta_{i,j} - \tau_{n;i,j})}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right) - c\tau_{n;i,j} = 0.$$

or

$$\gamma_{n;i,j} \left(\frac{2\bar{\pi}_i \theta_{i,j}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{(2\bar{\pi} + \tau_{n;i,j})(\theta_{i,j} - \tau_{n:i,j})}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right) =$$

$$\left(\frac{\sum_{m \in \omega_j} \beta_{n,m}}{\sigma_j} \right) \left(\frac{\bar{\pi}_i \theta_{j,i}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{(\bar{\pi}_i + \tau_{n:i,j})(\theta_{i,j} - \tau_{n;i,j})}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right) -$$

$$\left(\frac{\sum_{m \in \omega_i} \beta_{n,m}}{\sigma_i} \right) \left(\frac{\bar{\pi}_j \theta_{i,j}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{\bar{\pi}_j (\theta_{i,j} - \tau_{n;i,j})}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right) + \frac{c\tau_{n;i,j}}{\lambda}.$$

Solving in terms of $\gamma_{n;i,j}$ gives us

$$\gamma_{n;i,j} =$$

$$\left(\left(\frac{\sum_{m \in \omega_j} \beta_{n,m}}{\sigma_j} \right) \left(\frac{\bar{\pi}_i \theta_{j,i}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{(\bar{\pi}_i + \tau_{n:i,j})(\theta_{i,j} - \tau_{n;i,j})}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right) - \right.$$

$$\left. \left(\frac{\sum_{m \in \omega_i} \beta_{n,m}}{\sigma_i} \right) \left(\frac{\bar{\pi}_j \theta_{i,j}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{\bar{\pi}_j (\theta_{i,j} - \tau_{n;i,j})}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right) + \frac{c\tau_{n;i,j}}{\lambda} \right)$$

5

$$\left/ \left(\frac{2\bar{\pi}_i \theta_{i,j}}{\epsilon + \theta_{i,j} + \theta_{j,i}} - \frac{(2\bar{\pi} + \tau_{n;i,j})(\theta_{i,j} - \tau_{n:i,j})}{\epsilon + \theta_{i,j} - \tau_{n;i,j} + \theta_{j.i}} \right).\right.$$

Perhaps there is a way of specifying the amount of change in altruism in the winning that will lead to simpler calculation of the $\gamma_{n;i,j}$!

For m in i, $\bar{\beta}_{n,m}$ may be influenced by interactions between i and coalition other than j. Hence we can only talk about eliminating expected regret created by the current interaction, not others, and it is not possible to know the final value of $\bar{\beta}_{n,m}$ without knowing the full set of interactions the group is undertaking and what their outcomes were.

One thing that is noticeable is that this kind of adjustment will predict some fairly major changes in altruism towards members of other coalitions in particular. This is because there is no between-period "shadow of the past" in this relationship; the individual does not have to take into account the effect of preference change on expected regret that may be attached to actions in past period, which would tend to dampen preference change. Furthermore, because we do not problematize individual contribution to a coalition's optimal investment in conflict, non-cooperation within a group never occurs. If we elaborate the model to allow this, it will also tend to dampen preference change.

Classic User Manual

1.0 Overview of UI Features
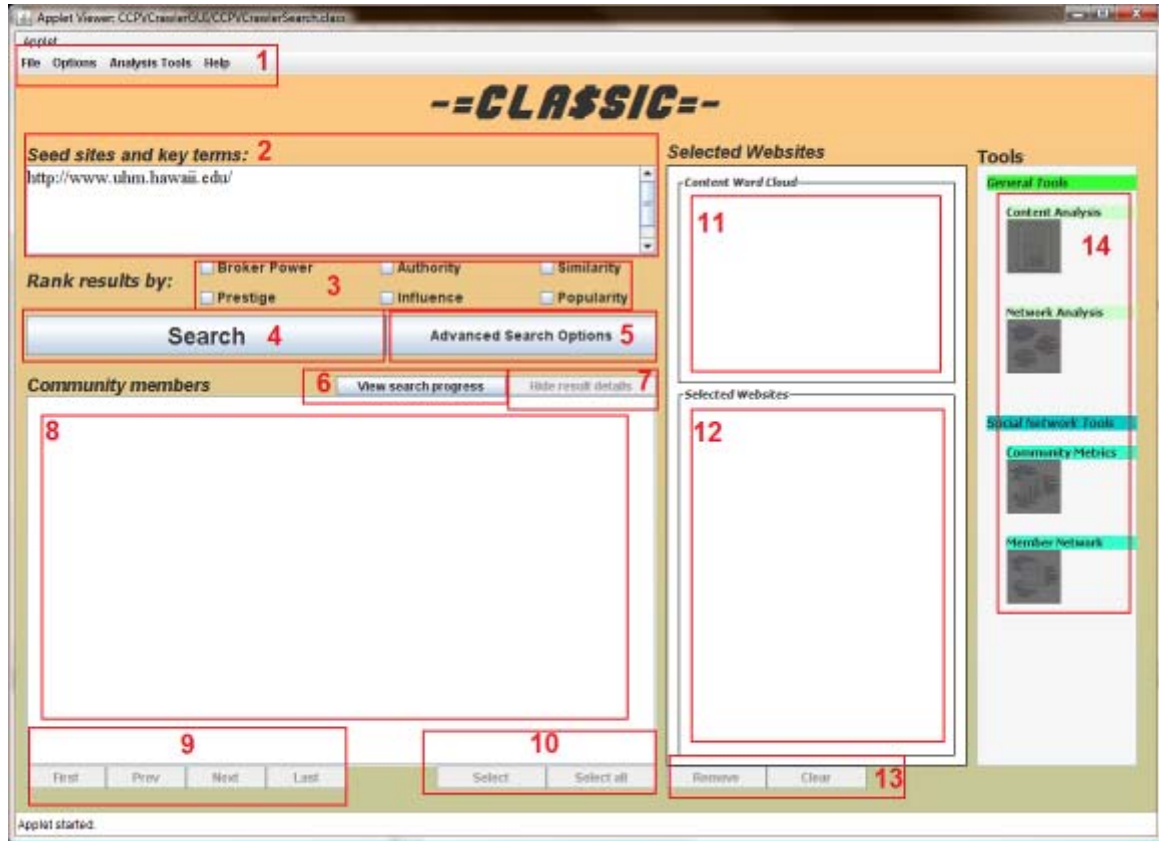
Figure 1: GUI Diagram. This is the layout of Classic.

1) **Menu bar**: The menu bar allows to user to access various functions associated with Classic that are not required for basic searching. These include saving/loading searches, GUI and dictionary options, analysis tool shortcuts, and basic help.

2) **Search box**: To begin a search, the user enters websites and search terms into this box.

3) **Preset ranking criteria**: Although the user is not required to select a preset ranking criteria, these options allow the user to specify how they want their results to be ranked.

4) **Search button**: Once search terms are entered and the user has selected any optional ranking criteria they want to use, the user must click the search button to begin searching.

5) **Advanced search options**: Advanced search options cover everything from filtering to custom ranking criteria.

6) **Search progress**: When a search is initiated, a dialog will popup and display the progress of the search. This dialog can be closed and if the user wishes to see the dialog again, he/she may press this button to do so.

7) **Details toggle**: Sometimes a user may want to see a list of website URLs rather than a lengthy result with extended information. Using this toggle, the user can switch between extended information and minimal information views.

8) **Results box**: All search results are displayed in this area.

9) **Results controls**: These controls are for navigating through the pages of results, where applicable.

10) **Selection controls**: Selecting results is required for analysis. These buttons allow for selection of results.

11) **Content word cloud**: As results are selected, their content is displayed as a word cloud here.

12) **Selected website list**: Selected websites are shown here for easy perusing.

13) **Selected website list controls**: Manipulation of the selected website list can be done using these controls.

14) **Analysis tools**: This area contains a quick menu for available analysis tools.

2.0 Explanation of UI Features

2.1 Menu items
Menu items contain functions that are not needed for basic use of Classic. *Sections 2.1.1* through *2.1.5* cover these items.

2.1.1 File : save/load
Saving and loading options are not currently implemented, but are an expected feature for future releases. These features would allow the user to store their searches on the server and therefore retrieve the saved data at any location where Classic is available. Searches are currently being stored on the server to optimize crawling, but are not yet linked to user profiles.

2.1.2 Options: crawler options
Crawler options are not yet implemented, as the application is not currently complex enough to warrant its use. However, as Classic grows, the user may need to make adjustments to the interface and these adjustments would happen using this menu option.

2.1.3 Options: dictionary options
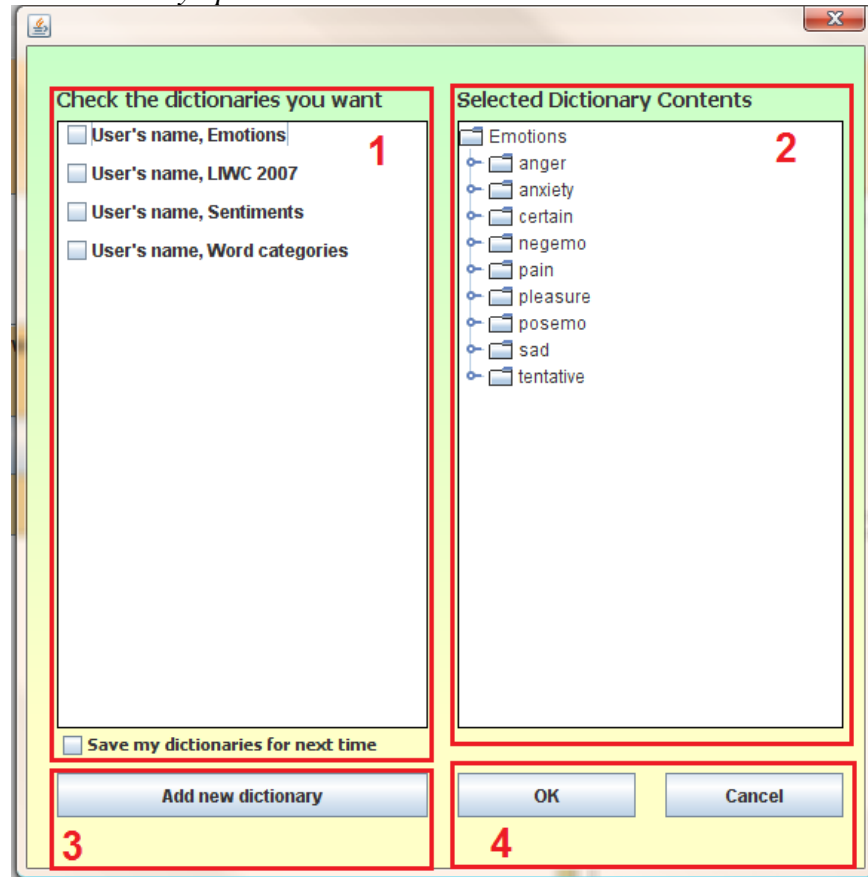
Figure 2: Dictionary options. This shows the various options associated with dictionaries.

Dictionary options gives the user control over which dictionaries they would want to be used in content analysis. Since content analysis can also be used as part of the ranking criteria, altering the available dictionaries may also impact the results of the search.

1) **Dictionary selection**: Dictionary selection begins by checking which dictionaries the user wants to use. Each dictionary is shown with the user name associated with the dictionary and the name of the dictionary. User names are added because future builds may include functionality for users to exchange dictionaries. Currently this feature is not yet implemented.

2) **Dictionary preview**: When the user moves their mouse over a dictionary check box in area 1, the dictionary is shown in area 2. This allows the user to preview the dictionary before choosing to select it. Additionally, the user may right click on the preview to undock the dictionary in a separate dialog (see below). This

dialog can then be use to construct a new dictionary from components of other dictionaries.

3) **New dictionary option**:
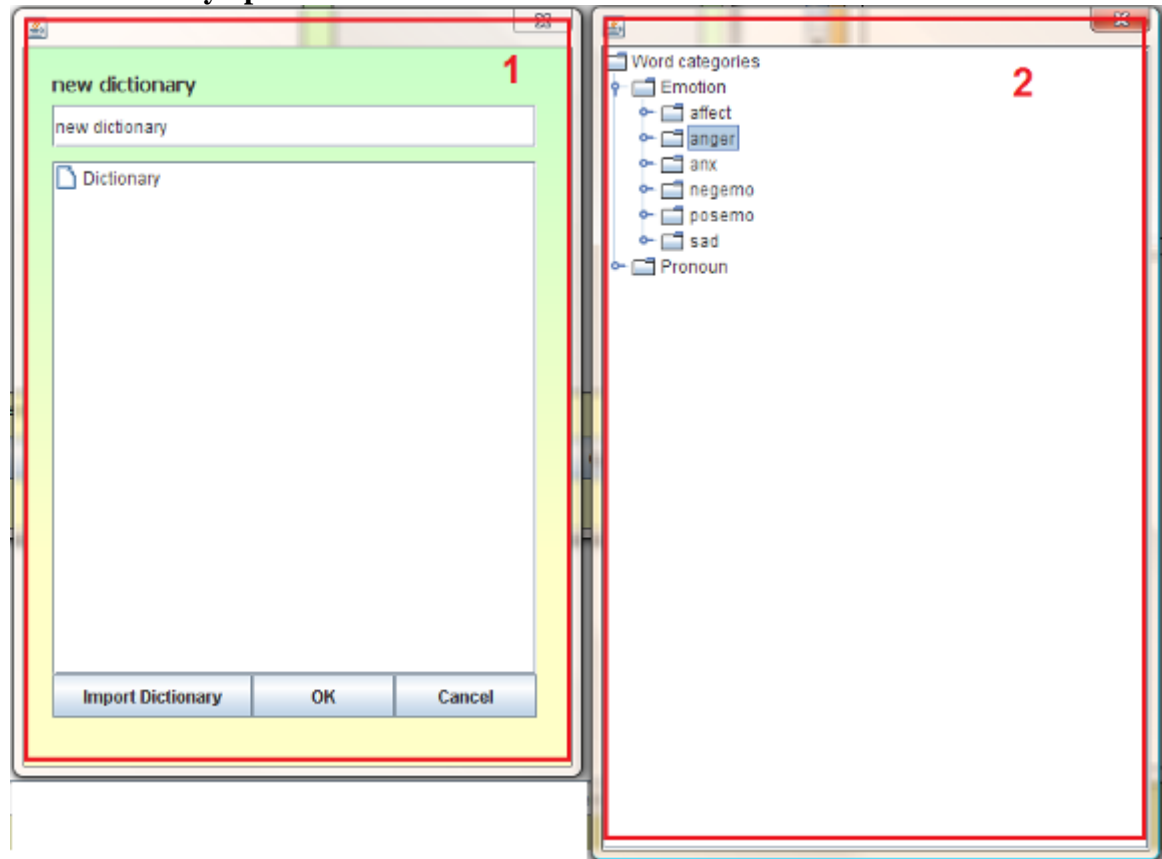
Figure 3: New dictionary construction. This shows how new dictionaries are made.

When the Add new dictionary button is pressed, area 1 comes up as a dialog. Here the user may construct their own dictionary by importing an existing one and then altering it or creating the dictionary from scratch. To facilitate combining dictionaries, the user may drag and drop dictionaries undocked dictionaries (see area 2) into the new dictionary dialog. The source dictionary remains unaffected by this operation. Once the user is satisfied with their new dictionary, they may press the OK button to see it added to the list of selectable dictionaries.

4) **Exit functions**: When the user wants to exit, they may either press the OK or Cancel buttons. Both will close the dictionary options dialog. The OK button will confirm their choices, while the Cancel button makes no changes.

2.1.4 Analysis tools: content analysis/ forum analysis / network analysis
These menus are not currently available. However, as these features are all planned for future development, the menu options exist as placeholders for later releases.

2.1.5 Help: help tips / about
Help tips give the user advice about how to search as well as answer frequently asked questions. About tells the user of who developed Classic and when.

2.2 Search box
The search box is where the user will enter all of their desired search terms. At present, the user is restricted to entering URLs as they appear in a typical web browser. This means the user must include the prefix "http://". Later builds will allow the user to enter key terms as well as URLs.

2.3 Preset ranking criteria
Preset ranking criteria allow the user to conveniently select ranking criteria that they might be interested in without having to derive the ranks using the website metrics. This is intended for the novice user, as power users might want finer control over their ranking criteria. Although equations exist to describe each of these preset criteria, they are not currently implemented.

2.3.1 Broker Power
Broker power represents the amount of influence a particular member has between two communities. For instance, one might imagine a search resulting in a community composed of two sub-communities with few connections between them. Those sites that do connect the sub-communities will have high broker power.

2.3.2 Authority
Authority is how trusted a site is. Sites of high authority are considered to have valid information. This is useful particularly when there exist numerous "dummy" sites on the Internet that mimic the URL of other trusted sites in an attempt to fool the user.

2.3.3 Similarity
This measure defines how similar sites are based on content. Since this requires content analysis and content analysis is not yet implemented into the GUI, this feature is not ready.

2.3.4 Prestige
Prestige is a concept closely related to popularity, but differs in the fact that the number of sites linked is weighted. In other words, a prestigious site might be linked to other sites of high authority or prestige.

2.3.5 Influence
Sometimes it is necessary to determine the "movers and the shakers" of a community. Influence helps the user find these sites so they may be targeted.

2.3.6 Popularity
Popularity describes how many sites are linking to the site in question. The more sites that are referring to the target site, the more popular the site is ranked.

2.4 Search button
When the user is ready to begin searching, he/she presses the Search button. Once started, the application must register with the web services. This process should not be interrupted and therefore the search button is disabled until the registration and setup processes are complete. However, after the setup is done, the button is again enabled, allowing the user to ask for a new search and cancel the current one.

2.5 Advanced search options
When users demand more control over how sites are ranked and chosen for the community, they may use the advanced search options.

2.5.1 Advanced search options overview
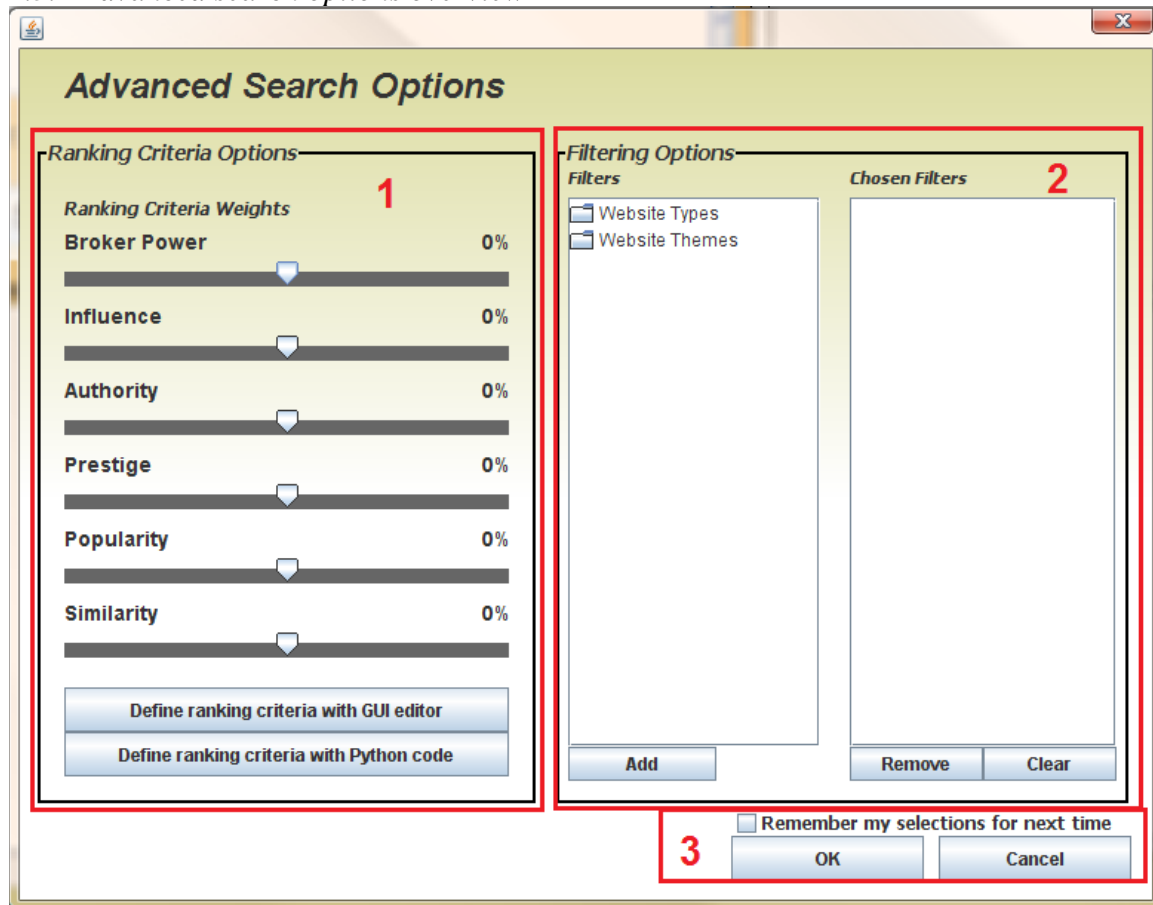
Figure 4: Advanced search options. This shows what options are available for advanced searching.

1) **Ranking criteria options**: For finer tuning of ranking criteria, the user can use these options to adjust everything from weights of preset criteria or completely new criteria.

2) **Filtering options**: To see only a particular set of results, filtering options provide the user a means of selecting which sites they wish to have in the results.

3) **Closing buttons**: When all desired options are set, the user must exit this dialog by either pressing the OK button or Cancel button.

2.5.2 Ranking criteria options
For finer control over the ranking criteria, the user may want to set weights for the present criteria. This is done using the sliders. Weights range from +100% to –100%.

2.5.3 Filtering options
If the user wants only to view pages of a certain type or content, he/she can use the filtering options to display only the results of his/her choosing. This feature is not yet implemented.

2.6 Search progress
Some processes in searching take significant time and thus the progress console provides the user with updates on what the search is doing. While the specifics of the updates may be unimportant to the average user, they at least provide feedback that informs the user that the program hasn't crashed or stalled. The progress console may be closed at any time and reopened using the View search progress button.

2.7 Details toggle
By default, the results will show a variety of information on each member of the community, including the URL, website description, title, and some basic tools. These greatly increase the amount of screen space that each result requires. To see a condensed view where only the URL displays, the user can click the "Hide result details" button. Upon pressing the button, the button then can be clicked again to show the details.

2.8 Results box
As the search progresses, results begin to populate the results box. These results are updated as the web service provides them and therefore the user can watch as the list is dynamically updated in real time. Results can be used for content analysis, etc.

2.9 Results controls
Some searches may result in hundreds of community members. Searches such as these would not be best shown on a single page, as scrolling quickly becomes a tedious task. Therefore, the result controls allow the user to view the results as separate pages where the first page contains the highest-ranking sites and last page contains the lowest-ranking sites.

2.10 Selection controls
All analysis tools require that the user select which sites he/she wishes to analyze. To do this, the user must click on a website in the result box and then use the selection controls to move the result to the selected website list. Selected results will no longer be

displayed in the result box to prevent the user from accidentally attempting to add the same site twice and to facilitate the selection of multiple results. If the results were not removed, then the user would need to scroll needlessly through every already selected result when searching for more sites to add.

2.11 Content word cloud
When users select items from the result list, the contents are automatically analyzed and presented as a word cloud. The content word cloud container shows a preview of all content within the selected sites. This is useful for quickly determining if what is selected is appropriate for the user's analysis needs.

2.12 Selected website list
All selected websites are shown in this list. Before any analysis tools can be used, this list must be populated with the websites the user wishes to analyze.

2.13 Selected website list controls
Pruning the selected website list is done using these set of buttons. The user may either cherry pick which results to remove or simply clear the list altogether.

2.14 Analysis tools
Classic comes with a variety of analysis tools. Some tools are exclusive to social networking sites that contain members, while others can extend to any site. In the future, classic will be able to determine what types of sites were chosen and dynamically display which tools apply to those choices.

2.14.1 Content analysis
Content analysis services are not yet implemented in Classic. However, in the near future, they will likely be added into Classic, as the tools have already been developed in a related project.

2.14.2 Network analysis
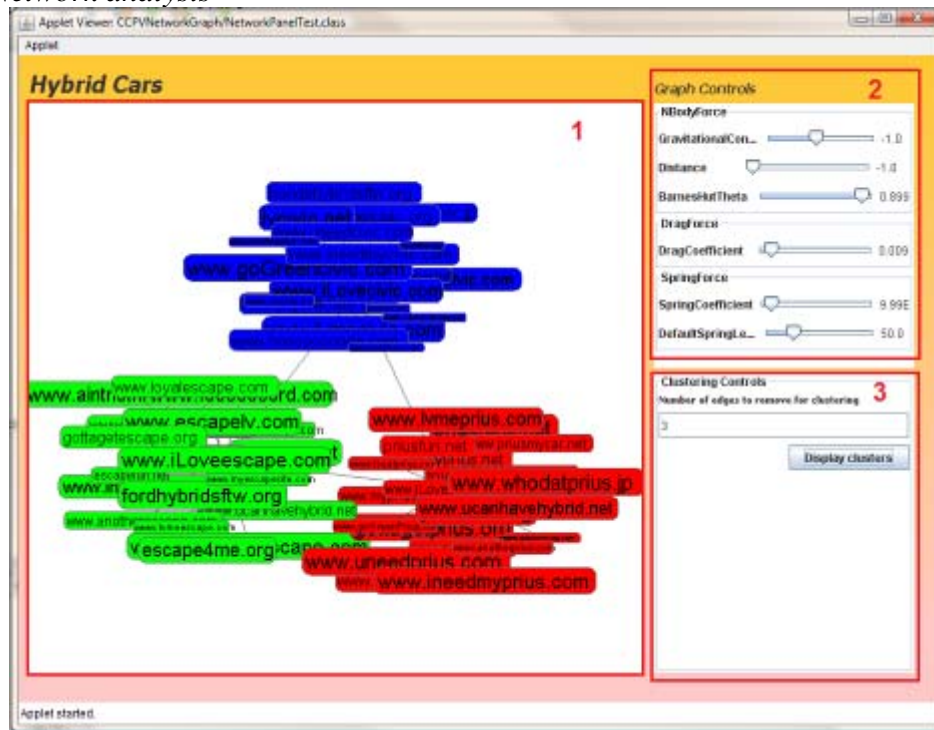
Figure 5: Network analysis. This shows a sample network graph created from sample mock data.

The network analysis tool allows the user to view all of the selected results in a network where the edges represent a combination of inlinks and outlinks between sites. Using edge-betweeness, the user can view how various sub-communities exist within the larger result network. Furthermore, right clicking the nodes can give the user greater insight into the content of the networks using content analysis tools, such as word clouds.

1) **Graph**: This is where the graph displays. A spring force model is used where nodes repel each other and edges pull nodes together. The edge lengths are dependent on how strongly the sites link together. Sites that contain many outlinks and inlinks to each other will have shorter edges, while those that contain few will have longer edges. If no links exist, no edge exists.

2) **Graph controls**: Since the graph is dynamic, often it is useful to adjust parameters of the graph to see how it will form under different conditions. For instance, adjusting how much the nodes repel each other by adjusting the gravitational force allows the user to increase or reduce clumping.

3) **Clustering controls**: Clustering helps the user find sub-communities within the community graph. Currently there is only one option of doing this and that is using edge-betweeness. The user must provide the number of edges to be pruned from the graph to find sub-communities. In this example, the user chose 3 edges, discovering 3 distinct sub-communities. The data used in this example was

constructed to be ideal. Real results may require more or less adjusting to discover sub-communities.

2.14.3 Community metrics

Community metrics refer to tools that track what community members are doing, etc. For instance, how often users post, reply, and lurk. These tools are closely tied to content analysis tools. This feature, though already developed significantly, has not yet been integrated into the Classic application.

2.14.4 Member network

If all selected sites are social networking sites, the member network tool becomes available. This tool allows the user to view the members of the community where a node represents a member and an edge represents a post reply or something similar in nature. This feature has not yet been implemented.

3.0 Search Process

3.1 Entering Search Terms

Before any searching can begin, the user must first specify what it is they want to search for. In the future, users will be able to enter both websites and key terms. At this moment, however, only websites are accepted.

3.2 Selecting Ranking Options

For the search algorithm to work, there must exist a ranking criteria that defines how well a site belongs to the community. By default, the application uses inlinks * outlinks as the ranking criteria. However, if the user chooses, he/she may use preset ranking critierias or define their own. Using a preset ranking criteria is done by simply checking the check boxes found in area 3 of the overview diagram. Any combination of these check boxes can be used. If the user wishes to define their own criteria, this can be done using the advanced search options. This is discussed in closer detail in section 2.5 Advanced search options.

3.3 Beginning the Search

When the user is satisfied with their entered search terms and ranking criteria, they may begin the search by pressing the Search button. Once pressed, the button is momentarily disabled to prevent subsequent searches. This is done because the application is communicating with the web service and needs to complete certain tasks before another search can be requested.

Immediately after the users presses the search button, a popup is displayed to give the user feedback on what the search algorithm is doing. This popup may be closed and opened again using the View search progress button.

Once the search algorithm has finished adding and crawling the seed sites to the community, the search button will be enabled again. At this time, the user may choose to

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interrupt the search and start a new search by pressing the search button again. The results will then be cleared and reflect the new search.

3.4 Viewing Results

As the search algorithm proceeds, new results will be added to the result box. These results by default show several pieces of information commonly associated with search tools. These include the website title, URL, and a description. Additionally, a word cloud describing the content of the site can be accessed using the more information button at the bottom of every result. If the user wishes to only view URLs, they may press the details toggle button represented in area 7 of the GUI diagram (see Figure 1).

Some searches may contain hundreds of results. Consequently, results are split into pages. Results at the top of the list are shown on the first page and have the highest scores. The user may pan through the pages using the result controls buttons seen in area 9 of the GUI diagram (see Figure 1).

As soon as results begin to display in the result box, the user can begin to select them for analysis. To do this the user clicks on the result they want then presses the select button. The user may select multiple results at the same time by holding shift while clicking. Additionally, all results can be selected with the select all button. Once results are selected, they will no longer appear in the results box. Instead, they are moved to the selected websites area. Selected websites may be removed from the selected website area and back into the results box by clicking on them in the selected website area and pressing the remove button. The user may also remove all results with a single click of the remove all button.

3.5 Interpreting Results

Once the user specifies which results they wish to analyze, they can access the various analysis tools. Content word clouds show the content of the websites in an intuitive manner where the larger and darker words are more common in the content. Selected websites automatically have their content input into a content word cloud, which will display in area 11 of the GUI diagram (see Figure 1). For more information on specific analysis tools, please see section *2.14 Analysis Tools*.

4.0 Implementation of Search Algorithm

4.1 Conceptual Diagrams
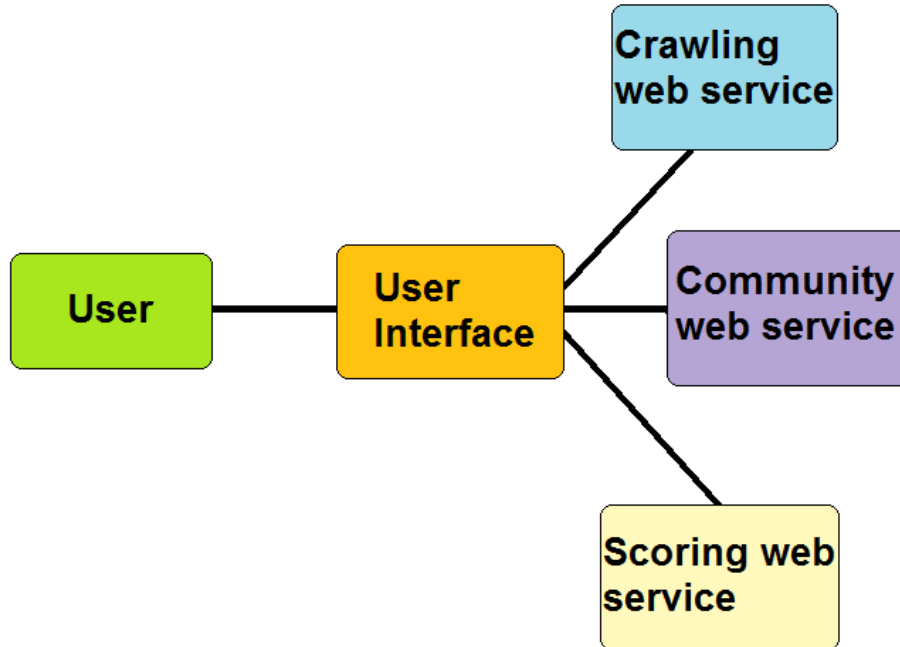
Figure 6: Conceptual diagram. This is a conceptual diagram of how Classic operates.

Though the user only interacts with the user interface, Classic is communicating with several web services to perform its duties. These services are split into three parts. The first is the web crawling service. It is responsible for crawling websites and providing raw data. The community web service is used to control the community and candidate lists and handles all functionality related to forming communities. Lastly, the scoring service handles all scoring of websites for their community membership. By having the services web based instead of located on the client end computer, we are capable of easily extending the services to any future applications.

4.2 Pseudo Code of Search Algorithm

The following pseudo code describes how the search algorithm works.

1) Get search terms from user interface. These terms are referred to as seed sites.
2) Add the seed sites to the community
3) Crawl the seed sites
4) Add all outlinks from seed sites to the candidate list
5) While stopping criteria is not met
      i)   Crawl the candidate list

ii)   Score candidates
iii)   Add best scoring candidate to the community
iv)   Add best scoring candidate outlinks to the candidate list
v)   Check the stopping criteria

Step 1) simply gathers what the user specified as the search terms. These terms must be converted into sites to seed the community. If URL addresses are provided, they may be added directly. Currently, there is no support for key word searching, but will likely be a future addition.

Step 2) adds the seed sites to the community. Here the user interface is communicating with the web services, informing them of what the user wants to crawl.

Step 3) requests that the web services crawl the seed sites.

Step 4) adds the outlinks of the seeds sites as candidates. Candidates are sites that are potentially members of the community, but have not yet been evaluated or accepted.

Step 5) loops through sub-steps i) through v) until the stopping criteria is met. Stopping criteria refers to the condition at which the search will cease. This is by default defined by a limit on the number of members in the community, however it can be adjusted to fit the users needs. The current user interface does not support custom stopping criteria, as this will likely be a feature in future builds.

Step i) requests a crawl of the candidate sites from the web service. Before any sites can be evaluated, they must be crawled.

Step ii) scores the candidates based on the ranking criteria specified by the user. Ranking criteria is defined by measurements taken on the website, including outlinks, inlinks, alexa score, and other measures.

Step iii) adds the highest scoring site to the community.

Step iv) adds all outlinks from the site just added to the community to the candidate list. Thus, the candidate list grows according to how many outlinks a website has.

Step v) checks the stopping criteria to break the loop.

Development of Forum Analyzer and Twitter Analyzer

1. Introduction

The internet has become the major place where people get information and exchange opinions. They participate in virtual communities of their interest by creating contents, reacting to each other, and collaborating (Li & Bernoff, Groundswell, 2008). As people spend more time on the web and do activities at the communities of their interest, getting to know about social network and virtual communities and analyzing the data about them are considered as one of the most important emerging technologies (IDC Report, 2008). the analysis of social network and communities is attempted based on the site data in many ways. This type of data analysis is considered as one of the most important emerging technologies (IDC Report, 2008). First, detecting the sentiment on the specific topic will be one of important analysis to people from business, government, academia, or non-profit organization. In business, the analysis results can used to monitor how people perceive the specific keywords and which virtual communities are good candidates for putting a company's advertisements or a new product's beta testing in terms of return of interest. In government, policy makers may want to find which virtual communities show stronger interest in specific topic. Second, the strength of membership and the level of commitment to the virtual communities can also be measured in various ways. They indicate how active and responsive the virtual communities are. In order to estimate the strength of membership and the level of commitment to the virtual communities, we try to look at how often members visit the site and how often they reply to others' postings and how consistently the topics are dealt throughout the website.

In this report we overview some of current web measurements. By utilizing these measurements along with the analysis of member network and content analysis , we try to build an application framework that can find the sentiment on the keyword, understand the communication pattern, and estimate the membership strength of virtual communities for the web forums and twitter.

2. Web data analysis

In this section, we try to show what types of analysis are available for the analysis of virtual communities. First, web metrics show general web traffic information and community metrics display various community specific measurements such as answer rate, response time, non-lurker rate, and so on. Second, we attempt to identify communication pattern among members and influential members by analyzing the member network with the help of social network theory. Lastly, content analysis provides the insight on what keywords are discussed and how people feel about them through word counting and dictionary.

2.1 Web metrics and community metrics

2.1.1 Web Metrics

Web metrics are one of popular measurements to check the site popularity and performance, which is produced mainly based on the server log. Since the crawlers can not go through the ISP server log and obtain the information, we have to retrieve it from several web information companies (listed below) manually.

> a. total visits
> b. page views
> c. unique visitors: (determine how popular a site is)
> d. total time spent on a domain
> e. pages per visit
> f. visits per person
> g. change in daily attention

However, the information doesn't have the same data format and also not many of sites provide the programmable access to the data (API). In our application, web information from Alexa web service is used, since it provides rich set of information as well as easy and stable access to the data. Currently, it provides the site ip address, registration date, Alexa Traffic Rank, Alexa inlink count, the list of related sites, last modified date, and so on.

2.1.2 Community Metrics

In addition to this web metrics, people have keen interest in the measurement of social media and virtual community for different reasons. Community metrics adds community specific data such as *page views per post* and *posts per thread* to the existing web metrics. Retrieval of these metrics will vary on the types of communities: Discussion board (forum-based), Social Media (Facebook, MySpace, LinkedIn, …), Blogs, Wiki, …. For this project, we focus on the Forum-based discussion board. Below is the list of community metrics we developed for the analysis of forum-based discussion board.

1) answer rate

Over a certain period, an answer rate can be measured by counting how many threads are answered and dividing the answered threads over the total thread counts.

```
AnswerRate = (#TotalThread - #NoReplyThread) / #TotalThread
```

This measurement shows how responsive communities are and how much members are concerned about other members.

2) 2-day answer rate

Along with 'answer rate', this measurement shows how many threads are answered within 2 days. It helps us determine to see how reasonably fast this community respond to questions or opinions.

```
TwoDayAnswer =
(#TotalThread - #NoReplyThread - #NotRepliedTwoDays) / #TotalThread
```

* "not replied within two days":

`#NotRepliedTwoDays` is counted shown as below. (2 days = 2880 minutes)

```
if(MeasuredResponseTime > 2880) {
  #NotRepliedTwoDays++;
}
```

3) response time

The response time is measured by computing the difference from the date of the replied message and the date of the original message. This measurement indicates how intensive the communication is and also how responsive the community is to other member's message. As one experiment for this measurement, Figure 1 shows the comparison of 2-day answer rate over 12 web forums[1] from different areas. Five different areas of web forums such as Political, Car, Sports, Computer and Health are chosen and around 30 threads are collected by the forum analyzer in development. Most of forums have high percentage of 2-day answer rate, but when it comes to the response time (median in minute), some forums have very fast response time, on the other hand, other forums have slow response time. Using this measurement, we find that the faster response time the community has, the responsive and intensive communication the community has.
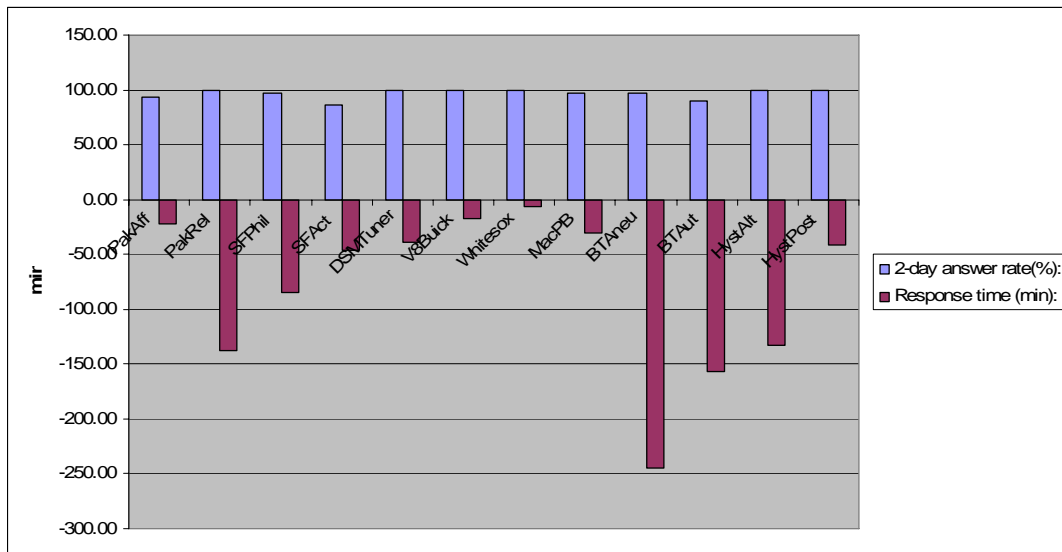
Figure 1. The comparison of 2-day answer rate and response time over 12 web forums

4) message size

The message size is measured by counting the tokens used in a posted message. We measure the message size of a starting message and then the size of the replied message.

---

[1] <Politics> PakAff & PakRel(pakilins.com); SFPhil & SFAct(stromfront.com); <Car> DSMTuner(dsmtuners.com); V8Buick(v8buick.com); <Sports> Whitesox(whitesox.com); <Computer> MacPB(PowerBook, macrumors.com); <Health> MDH(mdhealth.com); BTAneu & BTAut(brain.hastypastry.net); HBLung(HealthBoards); HystAlt & HystPost(Hystersisters.com)

This measurement can show how much members care about other member's messages. However, the purpose of the message and the conversation may shorten or lengthen the message size.

5) reply number & view number

The reply number and view number shows the activity level in the virtual community. Many replies and views mean lots of interest to the thread. The ratio of reply and view can indicate member participation.

6) mean reply depth

David Wiley proposed this measurement when he attempt to measure students' activity level in each online courses (2002). Mean reply depth is measured by counting the number of replies per thread and dividing it by total number of messages.

$$d_{crude} = \frac{\sum_{i=1}^{n} r_i}{n}$$

  d_{crude}: the mean reply depth for the group of messages

  r: the reply depth of the ith message

  n: the total number of message

$$d = d_{crude} \times ((n-b)/n)$$

  d: the adjusted mean reply depth

  b: the number of top-level messages that have no replies

  n: total number of messages

One example computation shows below.

1) A,B,C,D,H

A—D—A—B	(4 posts, 3-depth)
A—B—H	(3 posts, 2-depth)
A	(1 post, 0-depth)

A—D	(2 posts, 1-depth)
A	(1 posts, 0-depth)

$\overline{\qquad\qquad\qquad}$ 11 posts, 6 depths

$d_{crude} = (3+2+1)/11 = 0.54$

$d = 0.54 * (11-2)/11 = 0.45$

$p = 6/11 = 0.55$

Table 1 shows the interpretation of d value ranges.

d value	Possible interpretation
0 to 0.3	Monologue or lecture; no discussion
0.3 to 1.2	Simple Q & A; chit-chat
1.2 and higher	Discussion, Multilogue

Table 1. Interpretation of d value ranges. (Wiley, 2002)

7) Non-lurker rate

Non-lurker rate is measured by counting the unique authors from all the threads and dividing it by the total number of views. This measurement indicates what the actual participation rate is in the virtual community.

$pv = a/v$

   p: participation

   a: the number of unique authors

   n: the total number of views

Figure 2 shows the measurements of non-lurker rate and mean reply depth from 10 forums. Low non-lurker rate shows that there are more viewers than participants.
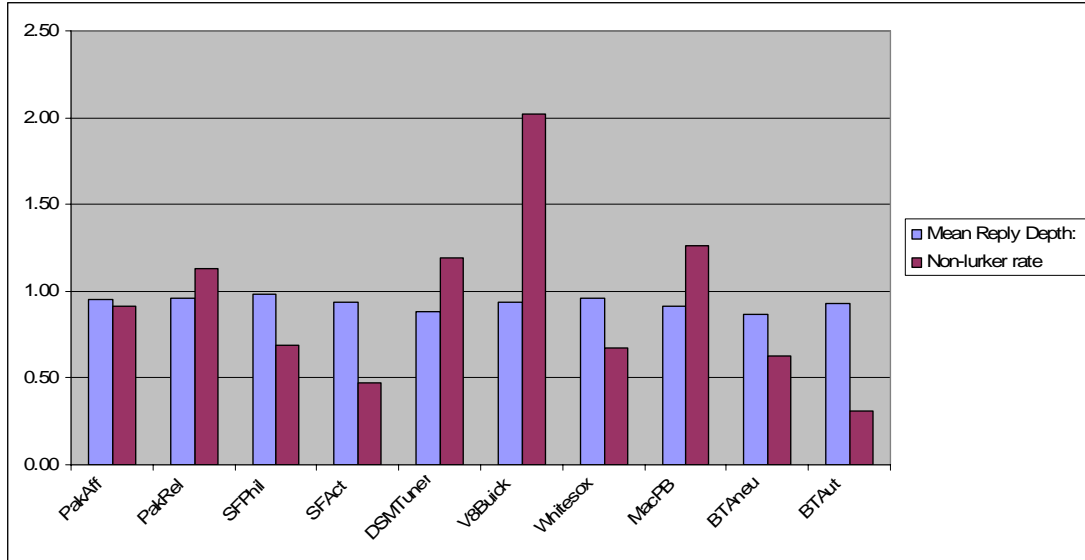
Figure 2. The comparison of Mean Reply Depth and Non-lurker rate over 10 web forums

2.2 The Analysis of Member Network

Member communication structure provides us the insight on which members are either active or influential and whether some discussions are governed by one member or by a group of members. We can construct a graph structure by identifying who initiates the thread and who replies to which posts. This graph structure of authors in a forum allows us to compute various measures of centrality from social network analysis

2.2.1 Constructing a graph

Graph is constructed by following the conversation sequence. The conversation starter is a starting node. The responder to it is the next node. If the same person responds to its own conversation, it will be ignored. Also, if the conversation does not have a response, this will be ignored. In this way, a graph shows who's responding to whom and who gets most responses. This graph structure also allows us to compute actor-level and group-level centrality.

2.2.2 Centrality measurement

Social network analysis by Wasserman & Faust (1994) provides us the definitions of actor-level and group-level centrality computations. The following Table 2 shows the actor-level centrality measurement.

2.2.2.1 Actor-level Centrality

Actor-level centrality is available through open-source graph software JUNG. Multiple examples of these measurements will be shown in following sections. JUNG library provides centrality measurements in different format of data: sum of degree for each node in a class 'DegreeScorer', sum of distance for each node in a class 'DistanceCentralityScorer', all pairs weighted shortest paths for each node in a class 'BetweennessCentrality'

TABLE I
Traditional measures of centrality

Type of centrality	Centrality measure	Standardized centrality measure
Degree	$C_D(n_i) = d(n_i) = \sum_j x_{ij}$	$C'_D(n_i) = \dfrac{d(n_i)}{(g-1)}$
Closeness	$C_C(n_i) = [\sum_j d(n_i, n_j)]^{-1}$	$C'_C(n_i) = (g-1)C_C(n_i)$
Betweenness	$C_B(n_i) = \dfrac{\sum_{j<k} g_{jk}(n_i)}{g_{jk}}$	$C'_B(n_i) = \dfrac{C_B(n_i)}{\left[\dfrac{(g-1)(g-2)}{2}\right]}$
Information	$C_I(n_i) = \dfrac{1}{c_{ii} + \dfrac{(T-2R_i)}{g}}$	$C'_I(n_i) = \dfrac{C_I(n_i)}{\sum_i C_B(n_i)}$

where: $d(n_i, n_j)$ = length of the geodesic from actor i to actor j;
$g_{jk}(n_i)$ = number of geodesics linking actors j and k that contain actor i;
g_{jk} = number of geodesics linking actors j and k;
$A = \begin{cases} a_{ij} = (1 - x_{ij}) \\ a_{ii} = 1 + \text{sum of values for all lines incident to } n_i \end{cases}$
$C = A^{-1}$;
c_{ij} = elements of C;
$T = \sum_{i=1}^{g} c_{ii} = tr(C)$;
$R_i = \sum_{j=1}^{g} c_{ij}$.

Table 2. Actor-level centrality measurement

2.2.2.2 Group-level Centrality

Actor-level centrality is available through JUNG API, but group-level centrality has to be computed separately based on actor-level centrality. Formula below comes from Social network analysis by Wasserman & Faust (1994).

1) Group Degree Centrality:

$$C_D = \frac{\sum_{i=1}^{g} [C_D(n^*) - C_D(n_i)]}{[(g-1)(g-2)]}$$

2) Group Closeness Centrality

$$C_C = \frac{\sum_{i=1}^{g} [C'_C(n^*) - C'_C(n_i)]}{[(g-2)(g-1)]/(2g-3)}.$$

3) Group Betweenness Centrality

$$C_B = \frac{\sum_{i=1}^{g} [C'_B(n^*) - C'_B(n_i)]}{(g-1)}$$

An example of actor-level and group-level measurements is shown below to verify the correctness of our using JUNG library for these measurements. Figure 3 shows the marriage relation of Florentine families.
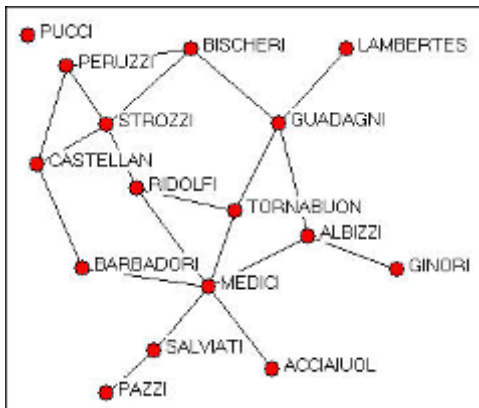
Figure 3. Marriage relation of Padgett's Florentine Families

JUNG library is used to compute centrality and the results are shown in Table 3. Actor-level centrality matches the ones in Wasserman & Faust (1994). Results fo group-level centrality shows at the bottom of Table 3. They are compared with other software results such as UCINET & Pajek. We find that JUNG library provides reliable results for the centrality measurements.

P.104. Padgett's Florentine Families, Marriage Relation

Jung's results: g = 15 (n12 is excluded from actor set) in comparison with P.183 Table 5.1

	degree: d(ni) p.178	degree: d(ni)/(g-1) p.179	closeness: sum[d(ni, nj)] p.184	closeness: (g-1)/sum p.184	betweenness: sum(gjk(n)/gjk p. 190	betweenness: sum/(g-1)(g-2)/2 p.190
1	1	0.071	38.000	0.368	0.000	0.000
2	3	0.214	29.000	0.483	19.333	0.212
3	2	0.143	32.000	0.438	8.500	0.093
4	3	0.214	35.000	0.400	9.500	0.104
5	3	0.214	36.000	0.389	5.000	0.055
6	1	0.071	42.000	0.333	0.000	0.000
7	4	0.286	30.000	0.467	23.167	0.255
8	1	0.071	43.000	0.326	0.000	0.000
9	6	0.429	25.000	0.560	47.500	0.522
10	1	0.071	49.000	0.286	0.000	0.000
11	3	0.214	38.000	0.368	2.000	0.022
13	3	0.214	28.000	0.500	10.333	0.114
14	2	0.143	36.000	0.389	13.000	0.143
15	4	0.286	32.000	0.438	9.333	0.103
16	3	0.214	29.000	0.483	8.333	0.092
Group Centrality:						
JUNG		0.275		0.362		0.437
UCINET		0.257		0.322		0.437
UCINET 6		0.267				0.383
Pajek						0.383

Table 3. Results of actor-level and group-level centrality using JUNG and other software

The centrality measurements allow us to understand who's more influential than other members and how centralized the communication within the communities is. For instance,

from the experiment over 12 forums, by looking at the graph visualization and group betweenness centrality, Whitesox fan forum shows more centralized membership networks (Betweenness centrality: 0.711) than distributed V8 Buick forum (0.253). Using this centrality measurement, we can presume that there are more influential members leading discussions in Whitesox fan forum than V8 Buick forum.
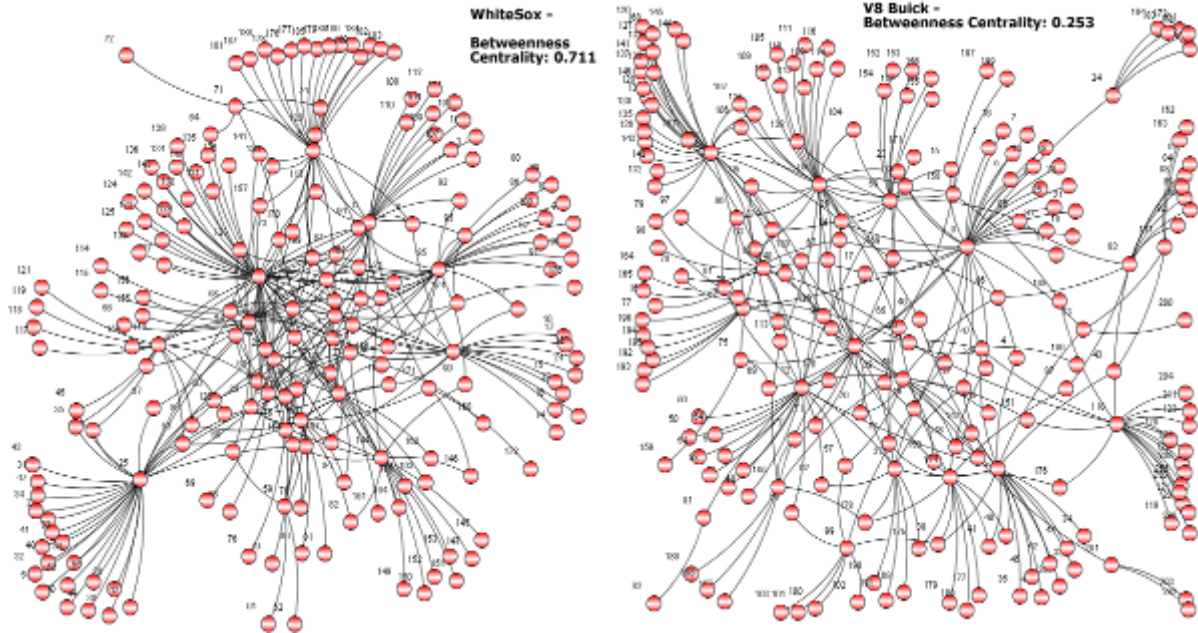
Figure 4. The Comparison of Group Betweenness Centrality: WhiteSox fan forum vs. V8 Buick forum

More examples of the use of centrality measurements are introduced in following sections.

2.3 Content Analysis

Content analysis provides us the tool of monitoring trends on the specific keyword and the sentiment around it. It counts Content analysis in the forum analyzer can show which keywords are discussed most and whether the target words are surrounded by negative, positive or any other emotional category words which are defined by a dictionary (LIWC 2007, Linguistic Inquiry Word Count).

2.3.1 Word Frequency and Word Cloud

Raw textual messages are tokenized and counted. This frequency table shows what words are most frequently used in the messages. Also the word cloud is a visualization of word frequency table with different font sizes.

2.3.3 Sentiment Analysis

Linguistic Inquiry Word Count (LIWC) is an application equipped with an internal default dictionary that calculates the percentage of words within several dozen categories that are used within any given text. It searches for groups of words that have been predefined as matching the various categories of interest in the dictionary (Pennebaker, Francis, & Booth, 2001; Pennebaker, Booth, & Francis, 2006). LIWC is an important tool for analyzing the sentiment or linguistic pattern in the given text. For instance, Figure 5 shows part of results from the same experiment mentioned before. We can observe that medical forum (healthboards.com) tend to use more personal pronouns than any other forums. Political forums tend to use more "we" & "they" than any other forums.
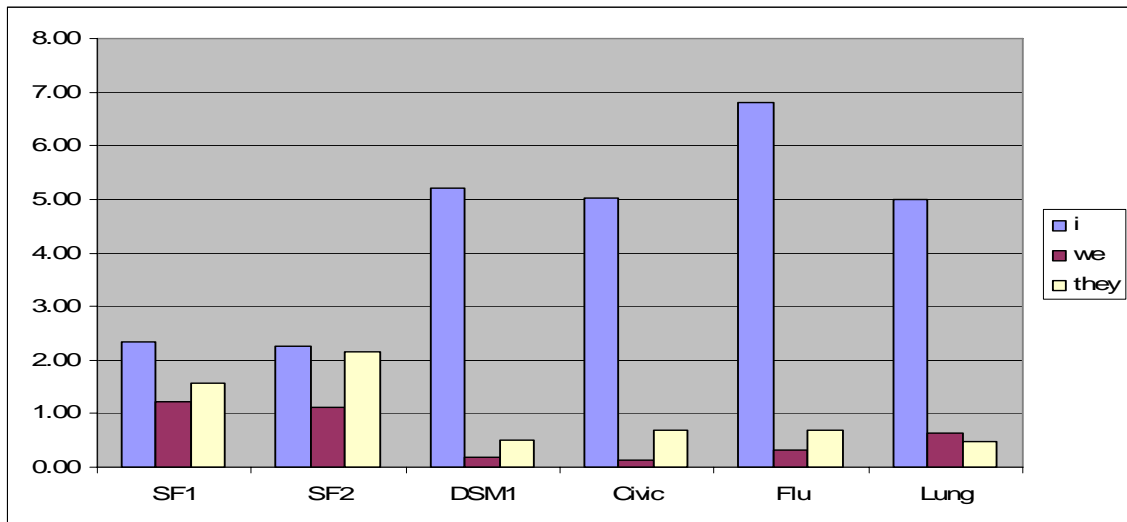
Figure 5. The comparison of pronoun usage over four forums: stormfront.com, dsmtuners.com, civicforums.com, healthboard.com

Figure 6 shows that political forum uses more anger words than others and medical forums use more sad words. Although this observation is not proved yet statistically, it is worth noting the pattern of word usage across different forums.
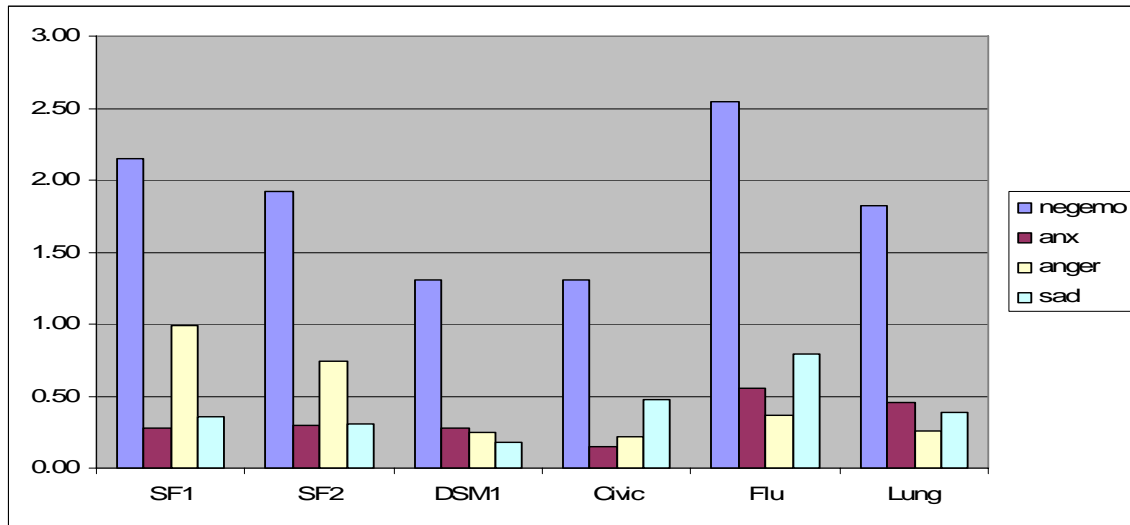
Figure 6. The comparison of emotional word usage over four forums: stormfront.com, dsmtuners.com, civicforums.com, healthboard.com

To use LIWC dictionary, our application utilizes Yoshikoder API (http://www.yoshikoder.org/). It was slightly modified to ignore the tokenization of number, punctuation, and their combination. 99 categories of General Inquirer dictionary are also converted to Yoshikoder xml version as well as 64 categories from LIWC-2007.

2.3.4. Keyword sentiment analysis

A user-defined set word can be searched within a sentence or out of sentence boundary with the defined distance neighboring the target word. These neighboring words can be collected as a bag of words and then used to find the sentiment or word usage pattern around the target word.

3. Development of Forum Analyzer

Web forums have become important data resource as people participate and interact in various topics of forum communities. Huge amount of valuable knowledge has been accumulated daily on the web. Data extraction and analysis from web forums are considered important technologies. The forum analyzer attempts to collect the messages and analyze the sentiment on the keyword, member activities, and the patterns of communication as we described in previous section. In this section, some challenges and

solutions of forum crawling is reviewed and the analysis of forum data is demonstrated with some sample data.

3.1. Architecture of Forum Analyzer

The architecture of the forum analyzer is shown below. The forum analyzer attempts to collect the various forum data and analyze them. First, it starts to crawl the sub-forums, threads, posts, and the message with the member identifications and store them in forum database. Once it finishes the crawling, it begins to analyze the retrieved forum contents. Then, it analyzes the patterns of communication, the strength of community, the communication structure, the identification of influential members, and the sentiment analysis on the keyword.
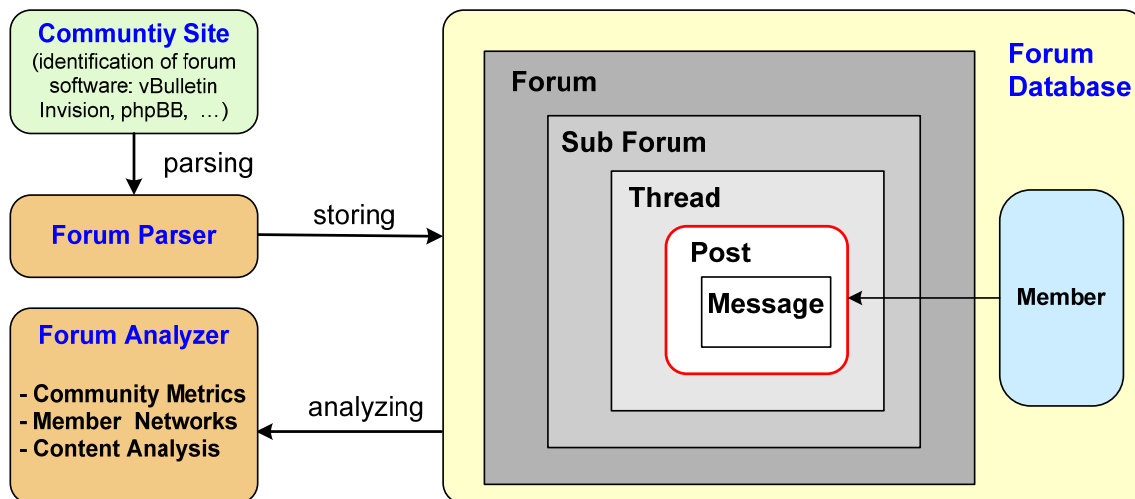
Figure 7. The Architecture of Forum Analyzer

3.2. Acquisition of forum data: forum crawling

Web forums use the various types of forum software. They may also have different customizations. These aspects make crawling the web forums a challenging task. In general, two categories of the forum data extraction are identified. They are template-dependent and template-independent (Yang et al., 2009). Many forum sites use some types of templates to generate forum pages. In template-dependent methods, also called wrapper-based methods, a crawler, which is the wrapper to the main forum data

extraction, identifies the properties of the specific styles and layouts shown in vBulletin[2] or phpBB[3] and extract the data. On the other hand, in template-independent methods, a crawler identifies forum data by handling with pages of different styles and layouts without relying on the forum specific information.

2.2.1 Template-dependent methods

The current version of forum analyzer in our project uses the template-dependent methods which can only identify the forum site with vBulletin forum software. This approach makes the crawler vulnerable to any customizations of the forum software and any updates of the software.

For instance, the patterns to be used to identify the forum data are shown in Figure 8.

```
forumUrlAfter=]//div[1]//a[1]
href=//a[@href]
message=//div[starts-with(@id,'post_message')]
meta=//meta[@name='generator'][contains(@content,'vBulletin')]
nextPageUrl=//tr//td//a[contains(@title, 'Next')]
pageUrl=//td[starts-with(@class,'vbmenu_control')]/text()
post=//table[string-length(@id) > 4 and starts-with(@id,'post')]
postCount=//a[starts-with(@id,'postcount')]
```

Figure 8. Patterns used to identify the forum data

This internal forum structure help the wrapper identity the target pages and their contents accordingly and extract them. The following is the typical structure of the forum.

When the styles or layouts are customized or upgraded to different ones, the patterns above should also be changed accordingly. The difficulty comes when the customizations of those pages are made. Also, some sites may have one more column or one less column for user convenience or site information. The template-dependent methods are not flexible enough to handle this change. This is why the template-independent methods can be a good solution to the task of forum data extraction.

2.2.2. Template-independent methods

---

[2] http://www.vbulletin.com
[3] http://www.phpbb.com

In template-independent methods, in general, the crawler is insensitive to the different styles or layouts of the forum pages. If all the forum pages have the table structure to display the forum data, we can narrow the task to identify the table and extract the data record inside recursively. The modified table data extraction task from [2] will be shown below.

1) Locate the table.

2) Identify the header columns and types (forum, thread, post, …).

3) Identify the row positions and types.

4) Associate data cells with their corresponding headers.

5) Go to 1 if another table is found on the same page

In the sample table layout below, each subforum-list has similar data columns to display such as forum, last post, threads, and posts shown as below.

Forum		Last Post	Threads	Posts

Also, each thread-list page has similar data columns: thread/thread starter, last post, replies(comments), and views.

Thread / Thread Starter		Rating	Last Post ☑	Replies	Views

In this method, still the data extraction is not flexible enough to handle different layouts and formats. Yang et al (2009) shows good examples of template-independent methods incorporating site-level information with different feature models. Site-level knowledge includes the link exchange between the list page and post page and the consistent layout structure of thread or post pages.

2.3 Current Forum Analyzer: v0.7

Figure 9 shows the current user interface of Forum Analyzer. It has an option to select the subforum from the list shown in Figure 10.
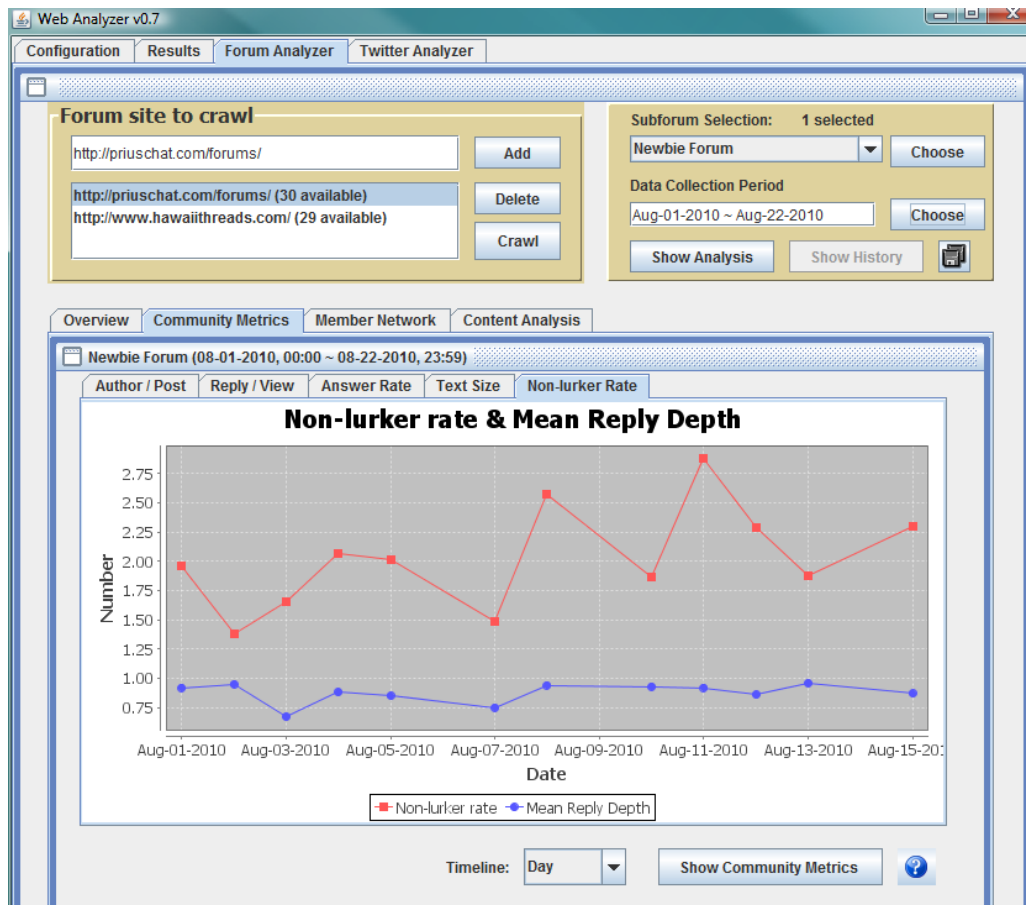
Figure 9. Current User Interface of Forum Analyzer: v0.7

Figure 10. Subforum Selection

Also the data collection can be done with user specified period shown in Figure 11.
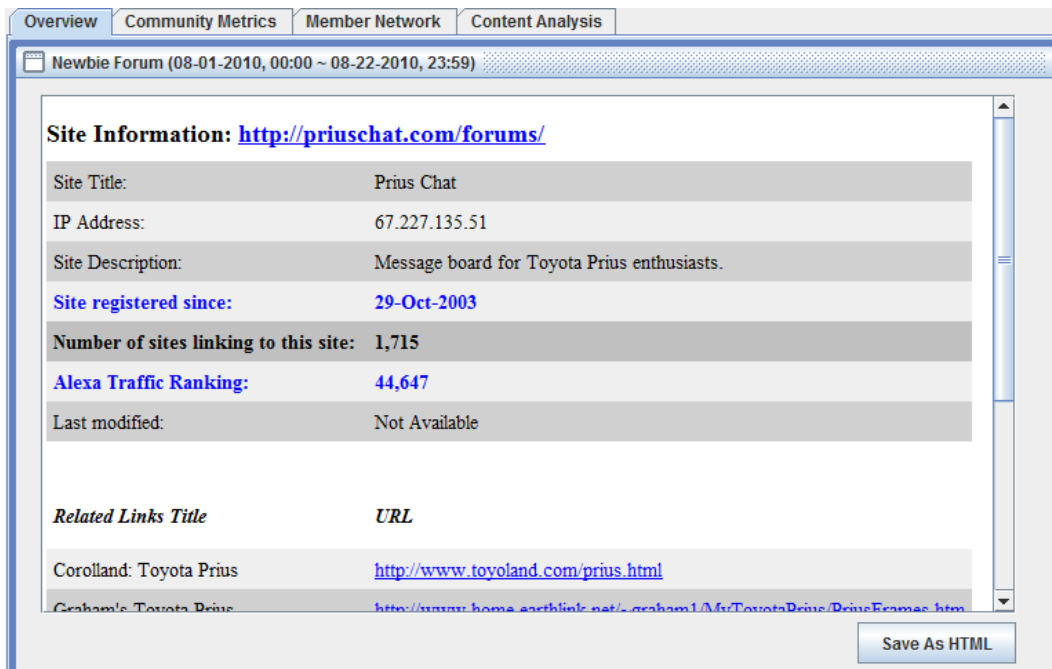
Figure 11. Selection of Data Collection Period

2.3.1 Web Metrics - web traffic information

Figure 12. Web Metrics

2.3.2 Community Metrics
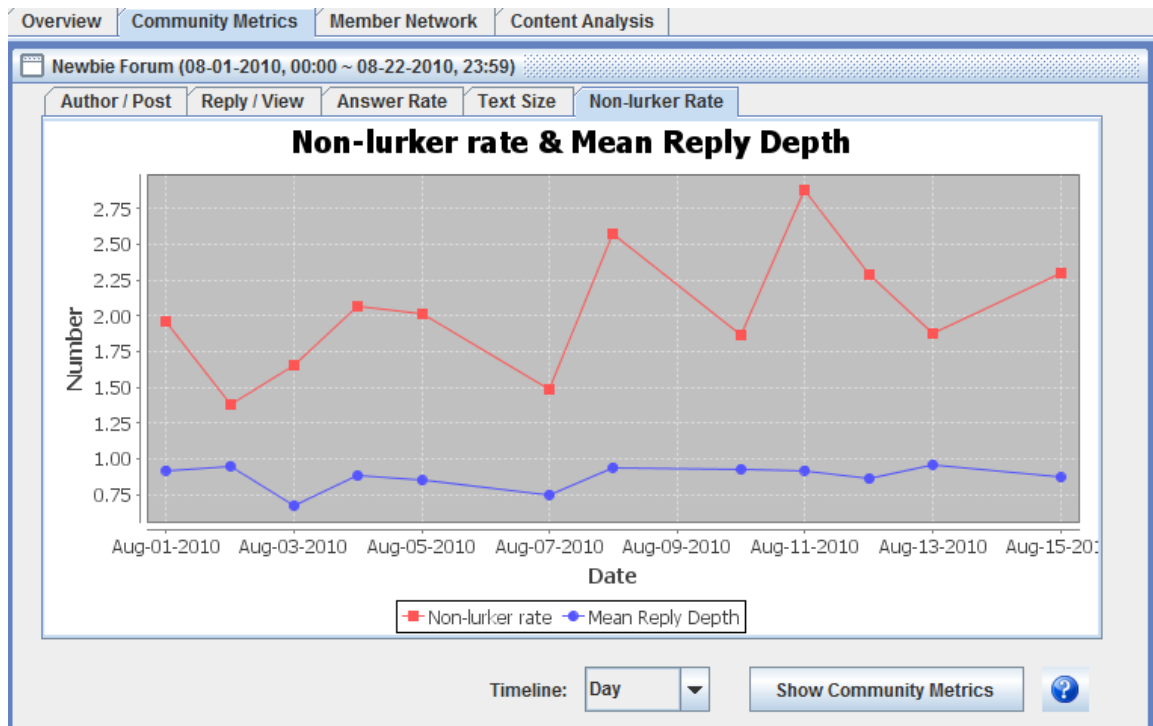
Figure 13. Community Metrics

2.3.3 Analysis of Member Network
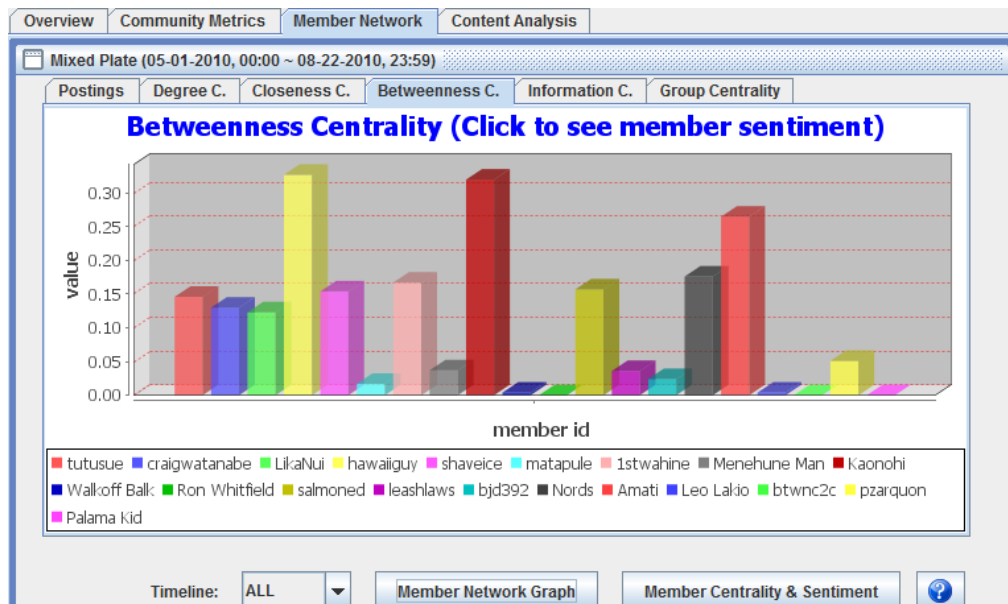
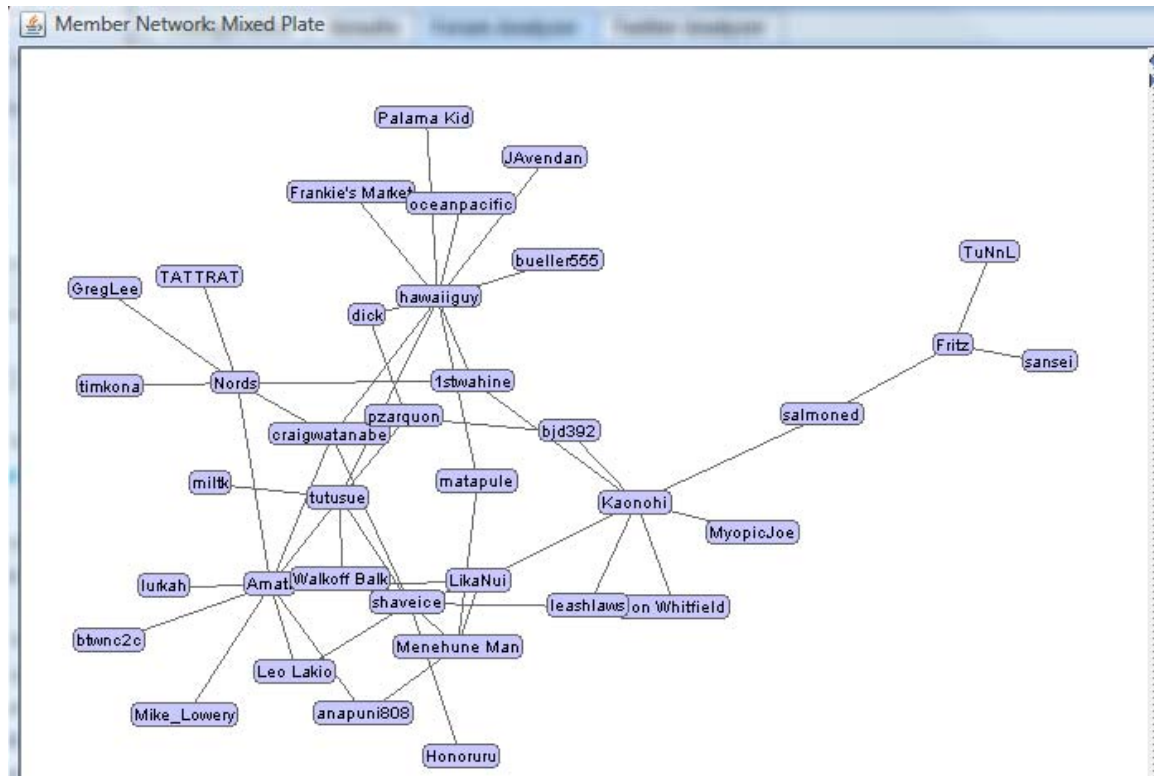Figure 13. The comparison of Betweenness centrality of Top 20 posting members

Figure 14. Graph visualization of Member Network

2.3.4 Posting Timeline with Posting view
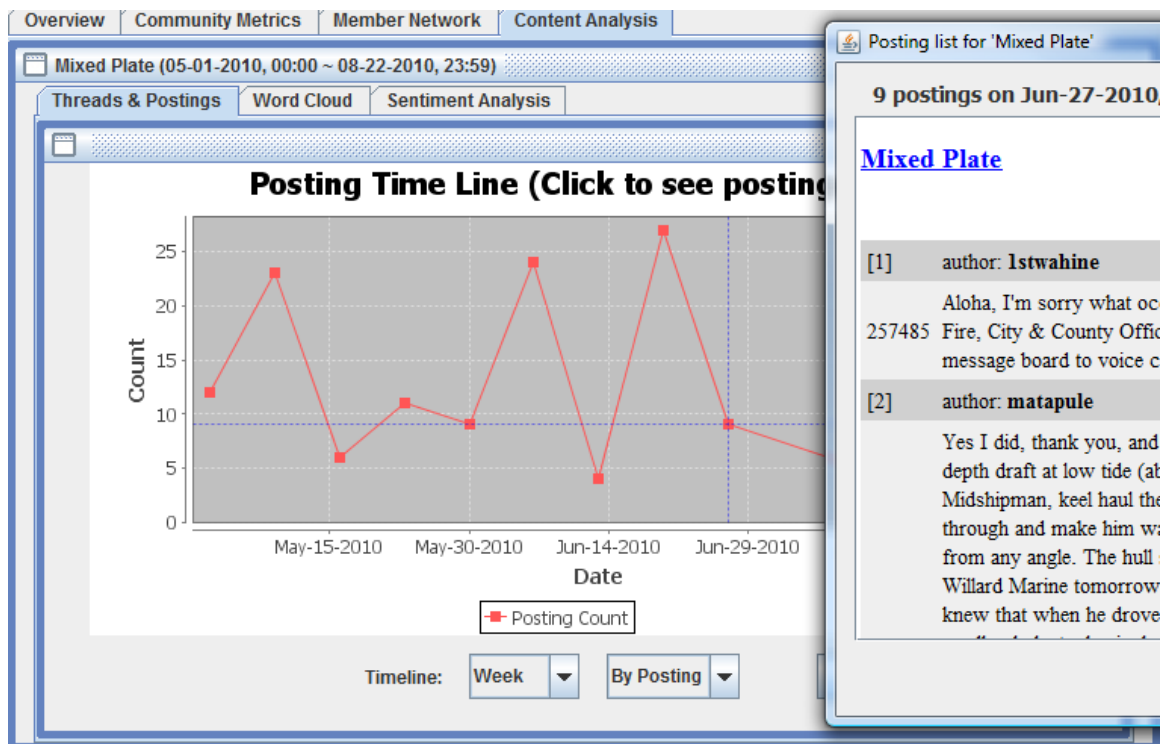
Figure 15. Posting timeline by week with the display of posting view

2.3.5 Word Cloud
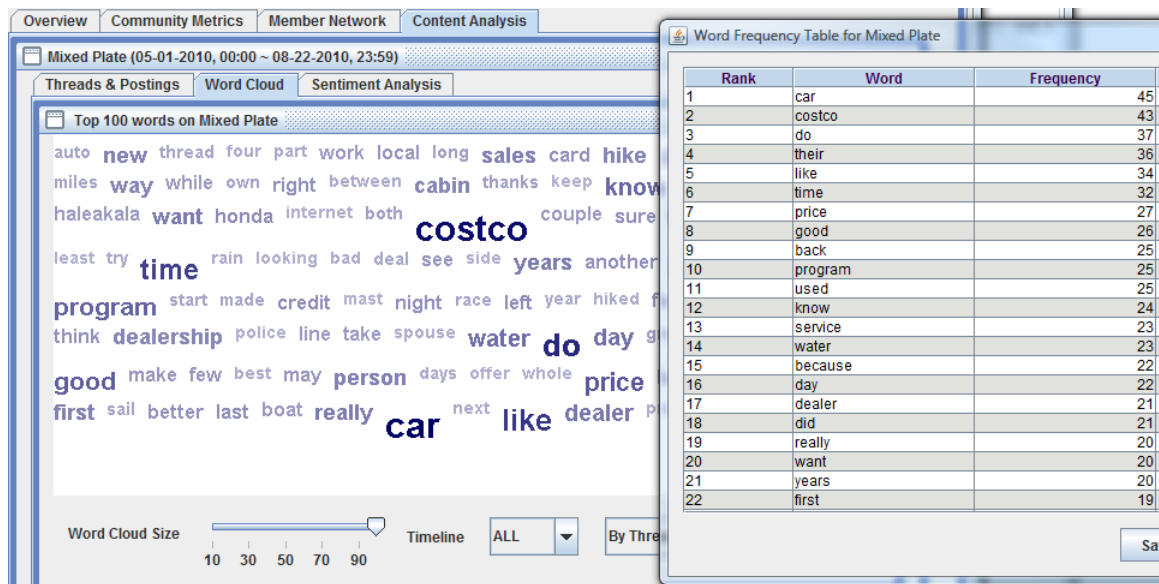
Figure 16. Word Cloud with its frequency table

2.3.6. Overall Sentiment Analysis
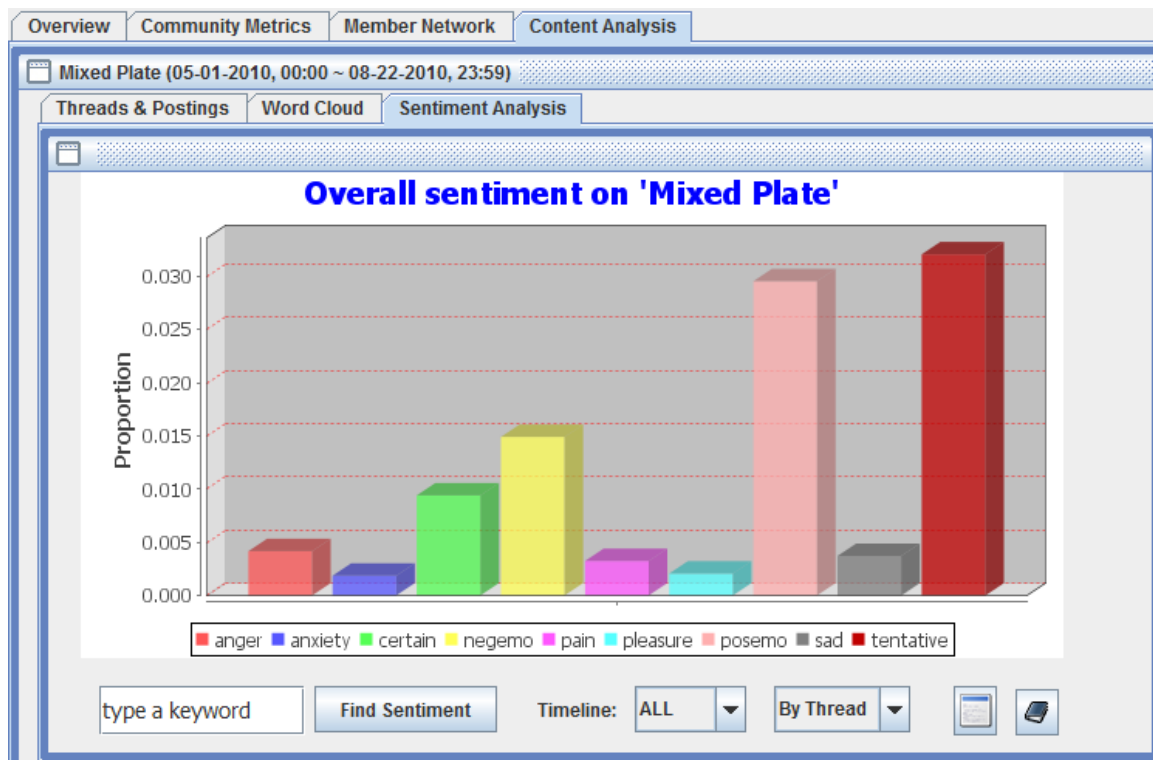
Figure 17. Overall Sentiment Analysis
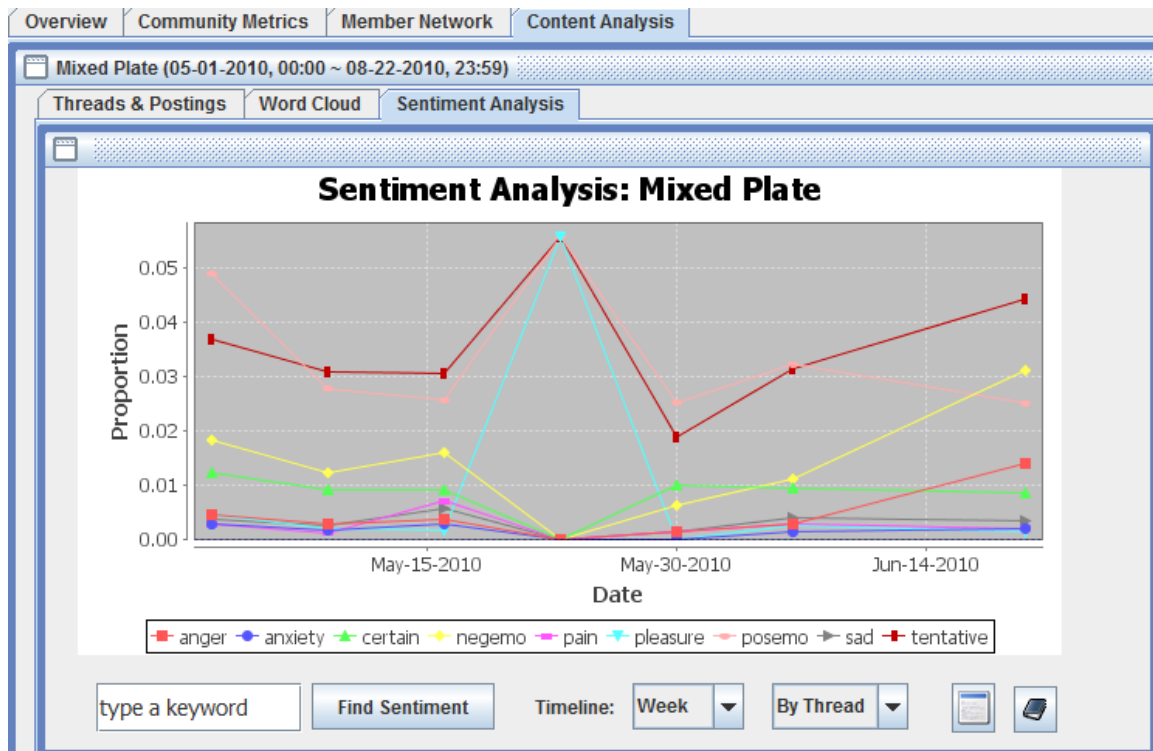
Figure 18. Sentiment Analysis by Timeline (Week)

3. Twitter Analyzer

The architecture of Twitter Analyzer is shown below in Figure
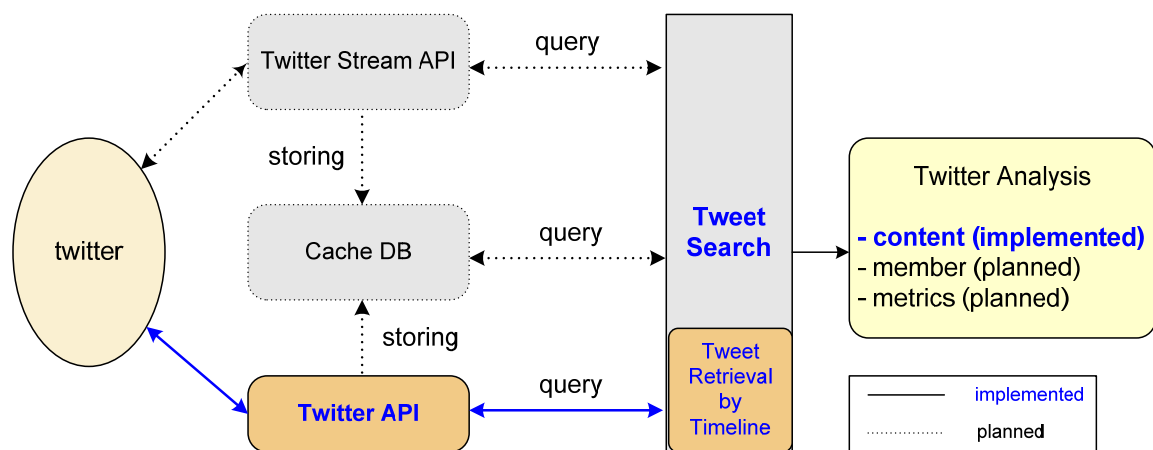
Figure 19. The architecture of Twitter Analyzer

3.1 Tweet Timeline By Hour with the display of Tweets
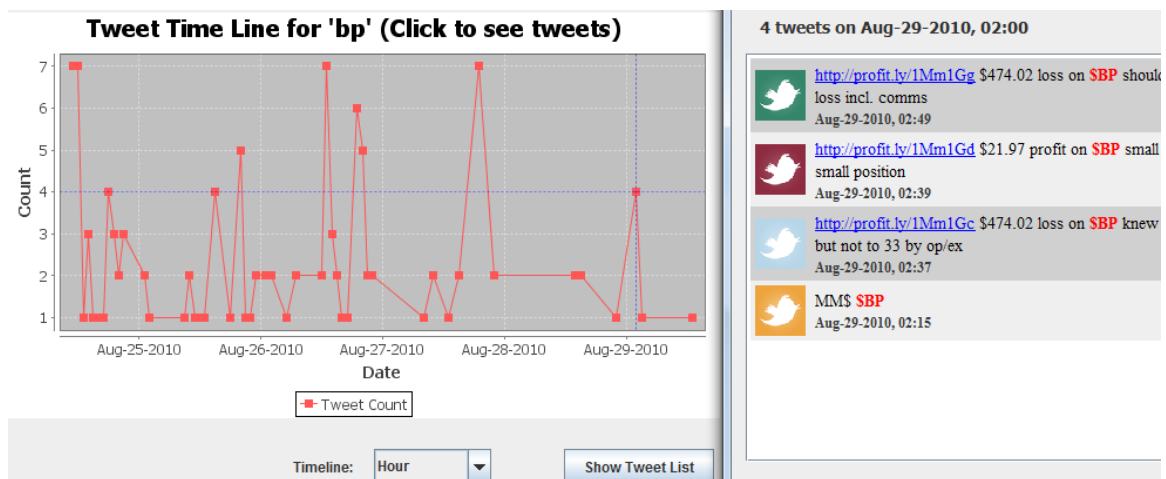
Figure 20. Tweet Timeline display

3.2 Word Cloud with Frequency Table

Figure 21. Word Cloud

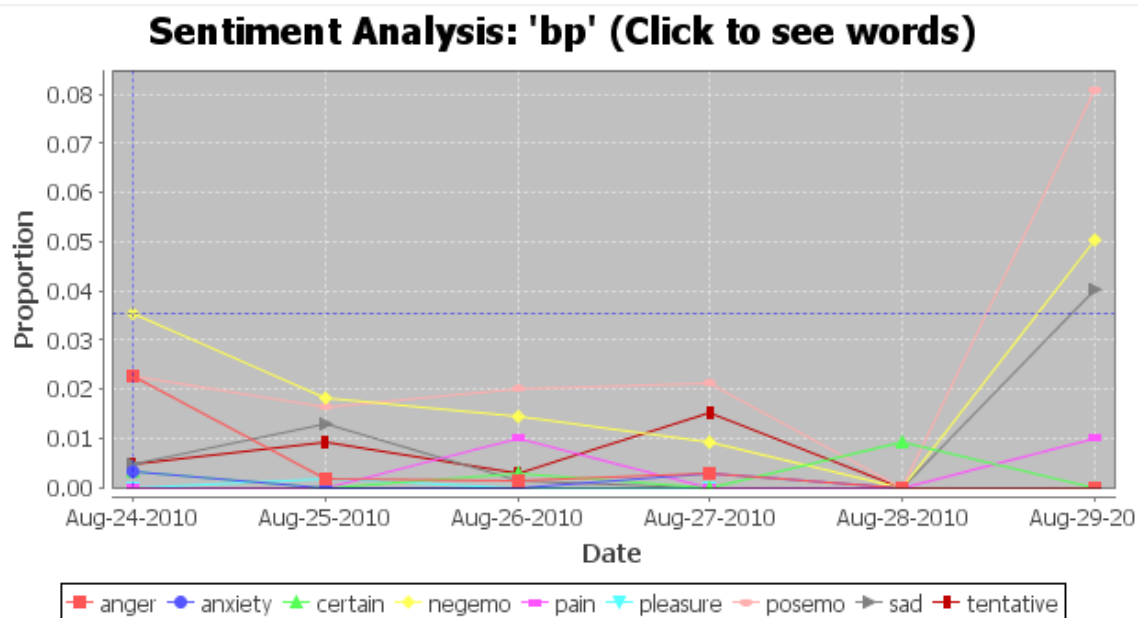Figure 22. Word Frequency Table

3.3 Sentiment analysis

Figure 23. Sentiment Analysis By Timeline

Dictionary Report

Frequencies for Sentiment Analysis on 'bp'

Dictionary entries	Count	Proportion
Sentiment	166	6.91E-2
Sentiment > anger	17	7.08E-3
Sentiment > anger > blam*	7	2.91E-3
Sentiment > anger > critical	2	8.33E-4
Sentiment > anger > cut	1	4.16E-4
Sentiment > anger > kill*	1	4.16E-4
Sentiment > anger > screw*	6	2.5E-3
Sentiment > anxiety	3	1.25E-3
Sentiment > anxiety > risk*	2	8.33E-4
Sentiment > anxiety > stress*	1	4.16E-4
Sentiment > certain	5	2.08E-3
Sentiment > certain > all	1	4.16E-4
Sentiment > certain > completely	2	8.33E-4
Sentiment > certain > sure*	1	4.16E-4
Sentiment > certain > totally	1	4.16E-4
Sentiment > negemo	50	2.08E-2
Sentiment > negemo > bad	1	4.16E-4
Sentiment > negemo > blam*	7	2.91E-3
Sentiment > negemo > critical	2	8.33E-4
Sentiment > negemo > cut	1	4.16E-4
Sentiment > negemo > disagree*	2	8.33E-4
Sentiment > negemo > disaster*	1	4.16E-4
Sentiment > negemo > doom*	1	4.16E-4
Sentiment > negemo > kill*	1	4.16E-4
Sentiment > negemo > loses	1	4.16E-4
Sentiment > negemo > loss*	4	1.67E-3
Sentiment > negemo > lost	2	8.33E-4
Sentiment > negemo > low*	7	2.91E-3

Save As CSV   Close

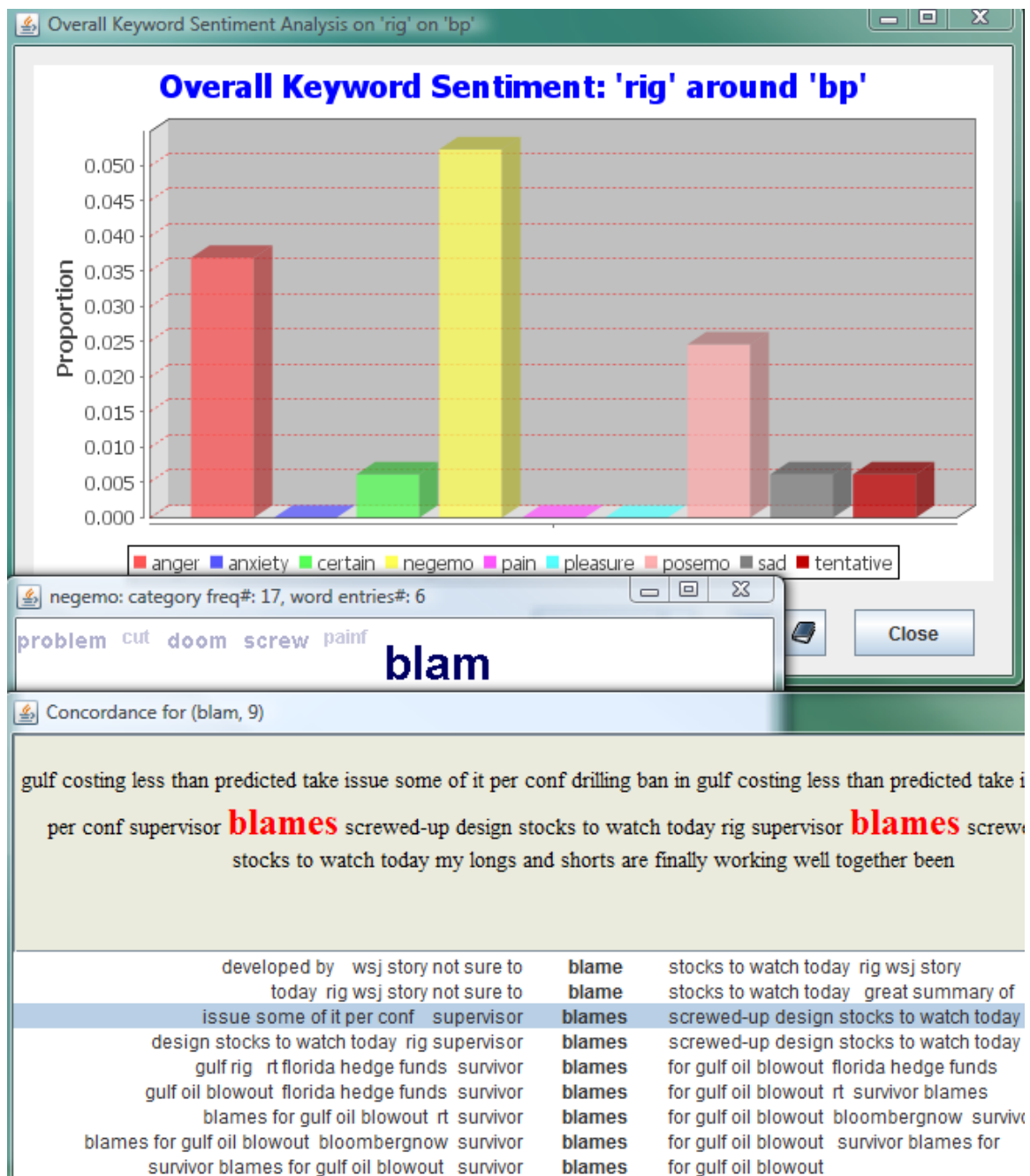Figure 24. Sentiment Category Frequency Table

Figure 25. Overall sentiment chart with concordance view on the keyword 'rig' on the tweets containing 'bp'.

References

Ellonen, H, Kosonen, M, & Henttonen, K., 2007, The development of a sense of virtual community, International Journal of Web Based Communities, Vol. 3, No. 1.

Blanchard, A. 2007, Developing a sense of virtual community measure, CyberPsychology & Behavior, Vol. 10, Num. 6.

Blanchard, A & Markus, M, 2004, The Experienced "Sense" of Virtual Community: Characteristics and Processes, The DATA BASE for Advances in Information System, Vol. 35, No. 1.

Buckner, J. 1988, The development of an instrument to measure neighborhood cohesion, Journal American Journal of Community Psychology, Volume 16, Number 6.

Davidson, W. & Cotter, P., 1986, Measurement of Sense of Community Within the Sphere of City, Journal of Applied Social Psychology,Volume 16, Issue 7.

Glynn, 1981, Psychological Sense of Community: Measurement and Application, Human Relaions, 34.

Henderson, H. and D'Cruz, B, 2004, The Role of Virtual Communities in the English Premier Football League.

Pinto, D., McCallum, A., Wei, X., and Croft, W. B. 2003. Table extraction using conditional random fields. In *Proceedings of the 26th Annual international ACM SIGIR Conference on Research and Development in informaion Retrieval* (Toronto, Canada, July 28 - August 01, 2003). SIGIR '03. ACM, New York, NY, 235-242.

Renninger, A. & Shumar, W., 2002, Building Virtual Communities.

Wiley, D. 2002, http://opencontent.org/docs/discussion09.pdf

Yang, J., Cai, R., Wang, Y., Zhu, J., Zhang, L., and Ma, W. 2009. Incorporating site-level knowledge to extract structured data from web forums. In *Proceedings of the 18th international Conference on World Wide Web* (Madrid, Spain, April 20 - 24, 2009). WWW '09. ACM, New York, NY, 181-190.